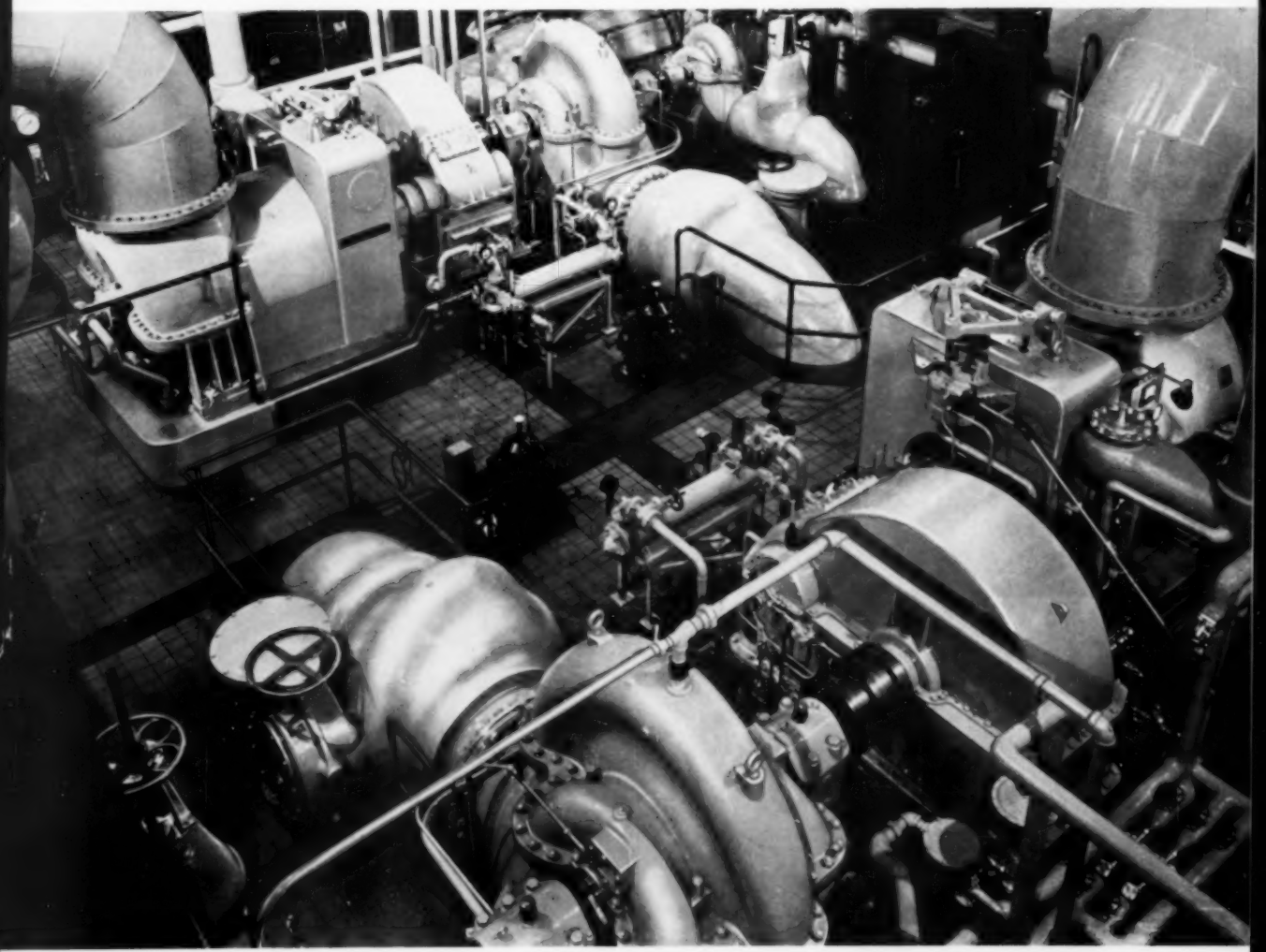
A Scranton Gillette Publication

NOVEMBER 1958

WATER & SEWAGE WORKS

WATER SUPPLY • SEWAGE DISPOSAL



▲ TWO 30 mgd De Laval centrifugal pumps at the Mayfair station of the Chicago Water Works. For an article on field testing of centrifugal pumps see p. 462.

● When the first rocket from Cape Canaveral, Florida reaches the moon, Lock Joint will have played a role in one of this generation's greatest dramas. To supply the torrent of water required every time a rocket blasts off — one-half million gallons or more — the experts operating this world-famous missile station rely on Lock Joint Prestressed Concrete Cylinder Pipe.

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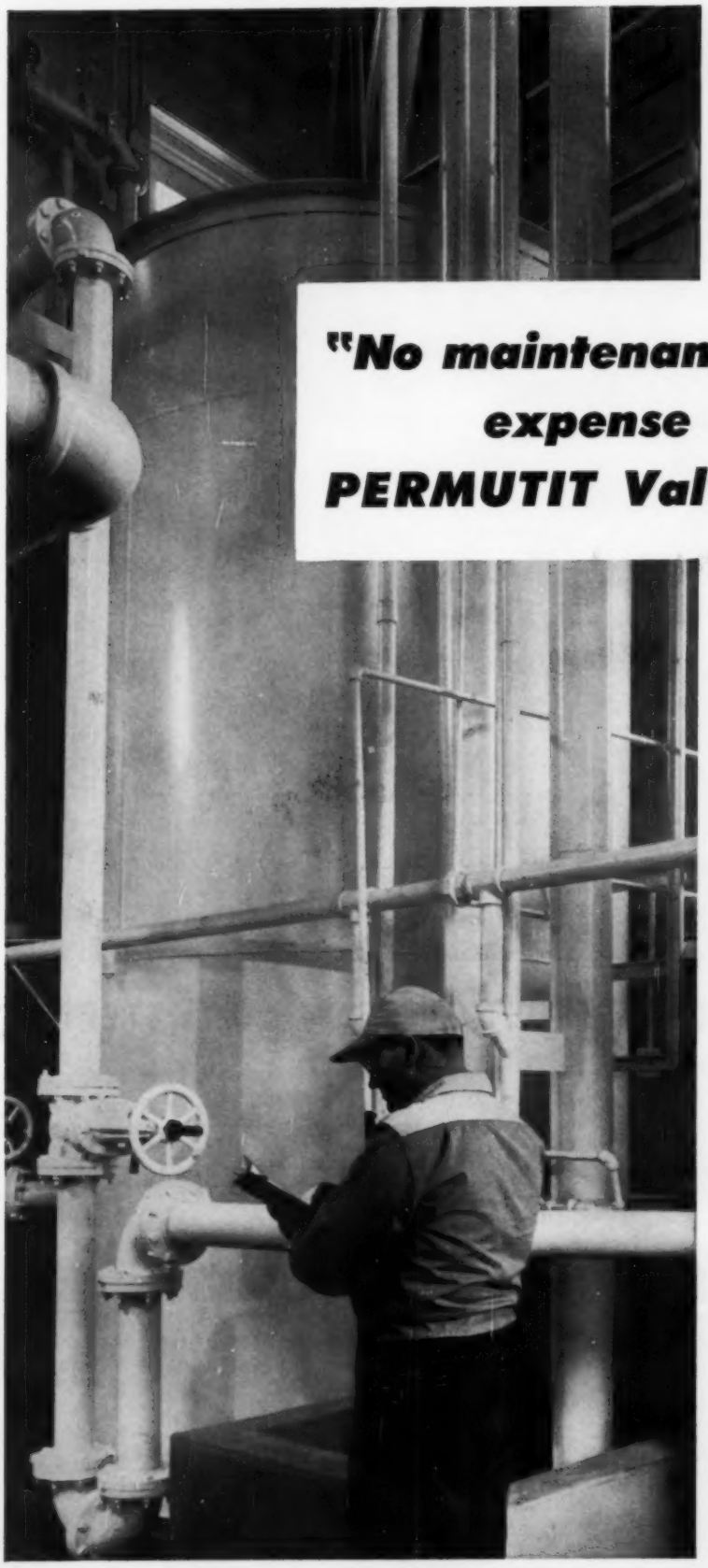

One of two Permutit Automatic Valveless Water Filters at O. M. Scott & Sons Co. Chemical Products Plant, Marysville, Ohio. Each filter is 7' diam. and rated at 116 gpm. The complete Permutit water-treatment system was engineered by H. A. Williams and Associates, Columbus, Ohio.

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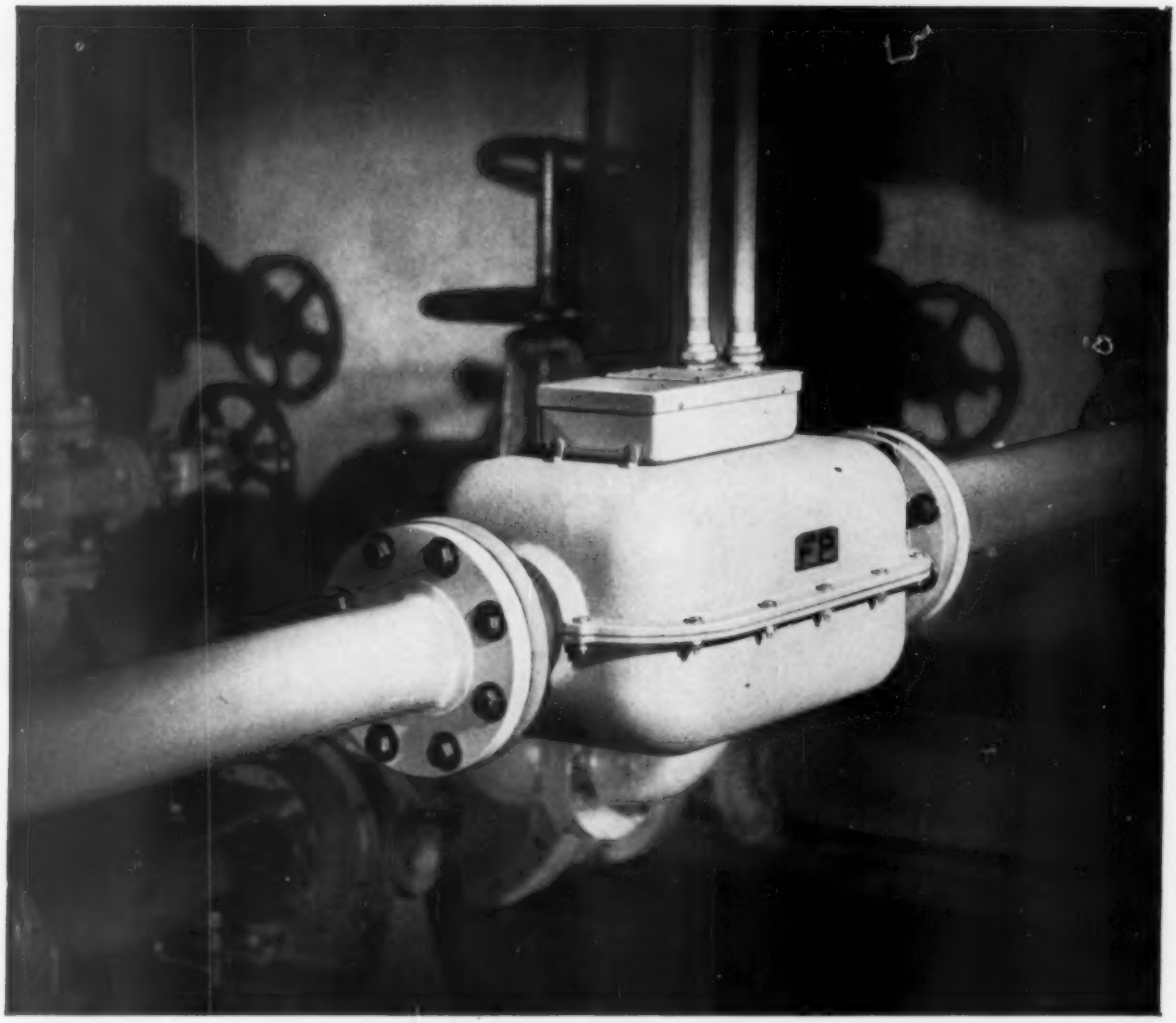

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FP

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Instrumentation and Chlorination

Vol. 105 No. 11

November • 1958

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Frank J. Schwemler, Commissioner of Water
Consulting Engineers—Havens and Emerson
Prestressed Concrete pipe by Price Brothers

Cleveland...

...uses Pratt Valves in a tight spot

City installations, with limited clearances and traffic problems, are never easy. This Cleveland project, tying a new booster station into two distribution lines, is about as tough as they come.

Here the specifications could not call only for "dependable valves" . . . it had to be "*dependable valves that are easy to install.*" This is where the engineer and contractor can tap the benefits of Pratt's long experience . . . major features of Pratt Butterfly Valves include exactly those things that simplify difficult jobs: minimum head room, versatile operators that can be buried without vaults . . . and design and construction such that the valve will always be easy to open or close.

If you would like to know more about Pratt Butterfly Valves, 40 page manual B2B is yours for the asking. *Henry Pratt Co., 2222 S. Halsted St., Chicago 8, Ill.* Representatives in principal cities.

HENRY PRATT

RUBBER SEAT Butterfly Valves

Briefs

19-Mile Tunnel Main beneath London is part of a $15 million water supply program due to go into operation in London, England in 1960. This 102-in. tunnel will draw water from the River Thames at Hampton and carry 70 to 120 mgd to the city's northeastern section. Flow will be by gravity. Features of construction of the tunnel, which was begun in 1954, are described—page 453.

Reversible Diatomite Filtration is a new development in the use of diatomite filtration with body feed. The system employs a thin porous membrane for the filter medium and by reversing the direction of flow through the membrane, both sides are used alternately. Tests indicate reasonable operating costs, applicability to peak load problems, and high removal of algae, bacteria, color and turbidity. Operation of the system is described—page 456.

Field Testing of Centrifugal Pumps—Part II covers the calculations, plotting and interpretation of results. Part I of this practical plant operating article appeared in the July issue and detailed the steps required in planning and conducting field tests. Part II appears on page 462.

Vertical-Mounted Horizontal Pumps offer a means of saving floor space in pumping stations, either existing or in the planning stage. An example of this type of installation is the San Pedro, Calif. water works—page 467.

Dissolved Oxygen Determination can be made advantageously by a modified Winkler method using sulfamic acid—page 469.

Regeneration of Ion-exchange Softeners may be accomplished more economically when large quantities of salt are handled by rugged facilities for storing and dissolving the salt—page 478.

Synthetic Detergents are of as much interest in Great Britain as they are in this country. A British Committee report on the subject covers analytical procedures, validity of complaints about foaming, and scope of research—page 479.

Underground Photographic Surveys can be accomplished with available equipment; such photographs are advantageous in locating the point or status of breaks or failures in sewers or deep wells—page 481.

Sewage Sludge as a Soil Conditioner has been recommended for many years. There is an upward trend in the extent to which sludge is being used for this purpose as indicated by a survey of 32 cities and 36 states—page 484.

Edmonds, Wash., Sewage Treatment Plant is an example of the importance of advance planning—page 490.

Sewage Effluent into Sand Dunes has proved an effective method of raising ground water tables and growing cattle fodder in Israel—page 493.

Abstracts of principal papers presented at four meetings (N. Y. Sect AWWA, NEWWA, Pa SIWA and Ill. Water Supply Conf.) are reported on pages 472, 475, 494 and 496.

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are thoroughly
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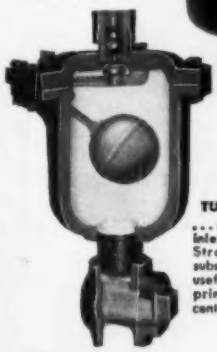
...safely release air during line filling and while it is in operation, permit air to enter as line is emptied—low-cost 3-way control.



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Before buying or specifying hydrants, be sure you know how these advantages may benefit your community.

Optional break flange gives double protection against impact damage

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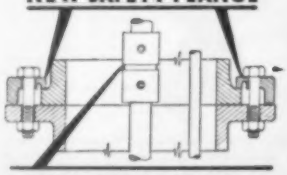


NEW SAFETY COUPLING

EDDY VALVE COMPANY
A Subsidiary of James B. Clow & Sons, Inc.

WATERFORD NEW YORK

News—Here & There

L. L. Hedgepeth

Staff Consultant in the Engineering and Construction Division of American Cyanamid Co. died of a heart attack on September 2. Mr. Hedgepeth, who was a nationally known authority in the field of water supply and industrial wastes engineering, was a Contributing Editor of *Water & Sewage Works* and had served in that capacity since 1952. He had been associated with American Cyanamid since 1949.

At Cyanamid, Mr. Hedgepeth served as consulting engineer to plants in the development of treatment and control systems. He was an adjunct professor in water sanitation at Rutgers University in New Brunswick, N. J.

A graduate of the North Carolina State College in 1921 with a degree in Chemical Engineering, "Hedge," as he was known to his friends, joined the consulting engineering firm of Wm. C. Olsen in Raleigh, N. C. and operated water plants designed by this firm. In 1929 he was employed by the Pennsylvania Salt Mfg. Co. as its first Technical Service Engineer in the sanitary engineering field and rose to the position of Technical Assistant to the Operating Vice President. From 1947 to 1949 he was Executive Technical Secretary of State Water Control Board of Virginia.

Hedgepeth was a member of many technical societies and associations and his committee assignments had been many. He served as a member of the Board of Control of FSIWA and was a member of the FSIWA publications and program committee. He was a Fellow in APHA, and was a past chairman of the Water Pollution Abatement Committee of the Manufacturing Chemists Assn., and was co-chairman of the Chlorine Committee of the AWWA and FSIWA.

"Hedge" had published many papers and articles and had received the AWWA Fuller Award, the FSIWA Bedell Award and the MCA Special Commendation Plaque; he was a member of Tau Beta Pi.

On second thought our complaint isn't too serious!

A Keen Eye

must be credited to representatives of

Yeomans Bros. Co. of Chicago. On our front cover in August there appeared four small illustrations, each representing an article which appeared in the issue. One of these articles was about Turnpike Service Areas in the Indian Toll Road." Since no illustrations were provided with the article, we took from our files a photo of a "turnpike plant" that had been used and identified in the annual review of sewage works published on p. 52 of our Feb. 1958 issue. The photo was not identified on the August front cover, but some sharp eyes at Yeomans recognized it as the Claremore, Okla. plant, which it was. We hope Indiana doesn't object.

Portland Cement Assn.

held an open house on Sept. 8, to demonstrate the "world's largest testing machine" at its new 3 million Structural Development Laboratory. The new Laboratory is part of the PCA Research and Development Laboratories at Skokie, Ill.

Ivan M. Glace

Consulting Engineering of Harrisburg, Pa., died suddenly on September 6. He was 71 years old. Until his retirement in 1957, Mr. Glace served as President of Glace and Glace, Inc., Consulting Engineers. He was active in many national societies including ASCE, AWWA, FSIWA, Pa. SPE, Pa. WWOA, and Md.-Del. W&SA.

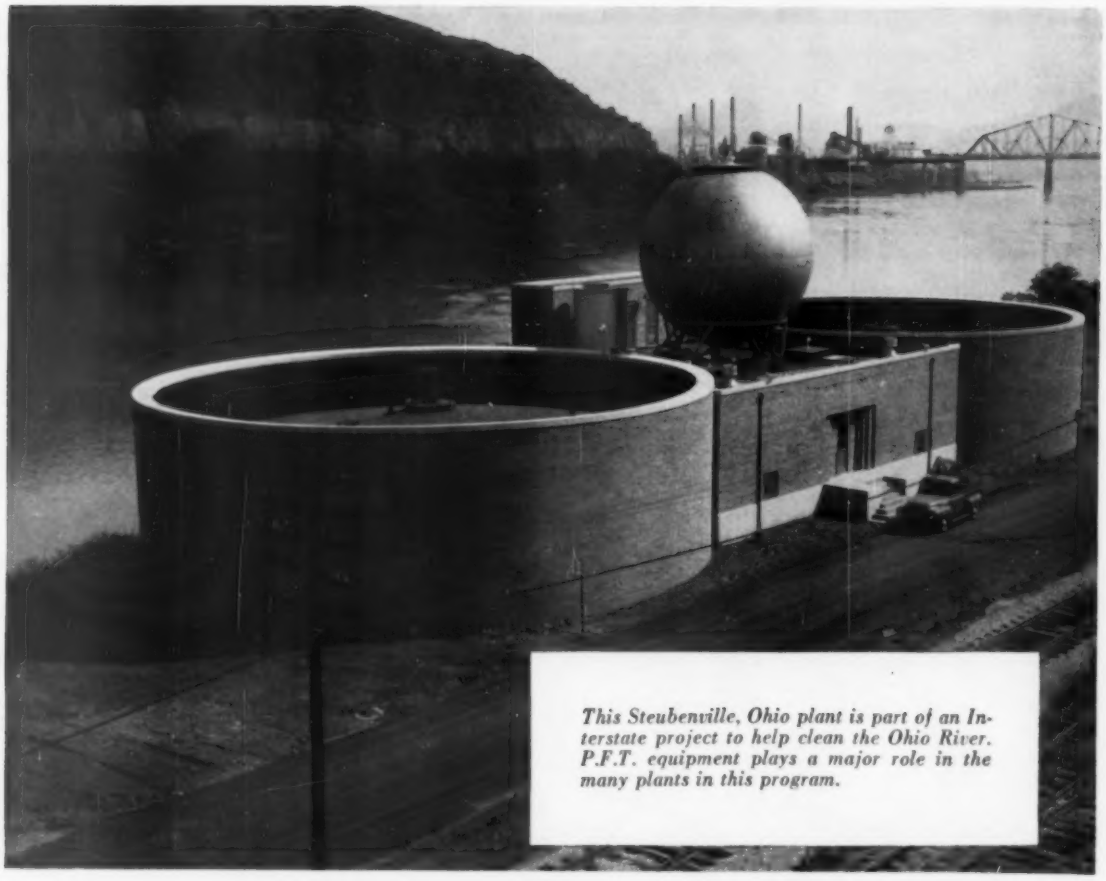
Mr. Glace was a founder of the Pa. Water Works Operators Assn., and had served as its Secretary for 23 years and President for one year. In recognition of his services to Pa. WWOA, that association had established the Ivan M. Glace award, given annually to an outstanding member of the association. He also was the recipient of the Fuller Award of AWWA and he was a past chairman of the Four-States Section of AWWA, past national director of AWWA, and past secretary and past chairman of The Purification Division of AWWA.

"Mike" as he was known, was an avid bridge player and was one of the organizers of the P_3 B_3 P_2 Club which met for bridge playing at most of the various association and sectional meetings in the east.

George W. Kelsey

Vice President of the Water & Sewage Works Manufacturers Assn. exemplifies the community service spirit of most men in the water and sewage works field. Mr. Kelsey who is Vice President of B-I-F Industries, Inc., of Providence, R. I. is proving his community spirit by serving this year as general chairman of the United Fund campaign of Providence. Mr. Kelsey has been associated with the United

(CONTINUED ON PAGE 9A)



This Steubenville, Ohio plant is part of an Interstate project to help clean the Ohio River. P.F.T. equipment plays a major role in the many plants in this program.

P.F.T. Equipment helps make Steubenville important link in Ohio River clean-up

Eight states are co-operating in the huge Ohio River restoration program. This new Steubenville plant is already doing its part. Across the river, the new Weirton, West Virginia plant will soon be completed. Alden E. Stilson & Associates are the Consulting Engineers for both plants.

Notice that Steubenville's high pressure storage sphere is mounted on top of the digester control chamber. A P.F.T. Gravity Gas Holder provides control for the high pressure gas compressor assuring its efficient operation during periods when excess gas is available for storage.

The P.F.T. equipment in Steubenville includes: two 65' Floating Covers, two Liquidometer Liquid Level Gauges with low level alarms, two #500 Shell & Tube Sludge Heat Exchangers, two Removable Supernatant Selectors and Gas Safety Equipment.

If you would like further information on any of this P.F.T. equipment, please write.

waste treatment equipment exclusively since 1893

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News—Here & There

CONTINUED FROM PAGE 7A

Fund campaign for the past several years and last year was vice chairman of the Fund. He is curently Vice-President of WSWMA, and is active in SAMA.

A. M. Rawn

A contributing editor of Water & Sewage Works was honored by the American Society of Civil Engineers at its annual meeting in New York. Mr. Rawn who is chief engineer and general manager of the Los Angeles County Sanitation District was named to Honorary Membership of ASCE, the highest honor it accords.

Purdue University

will hold two water works operators short school in November; an operators course, and a management course. A basic course was held in October.

Controlled Fluoridation

In the United States from 1945 to 1957 was summarized in the U. S. Public Health Reports for July. In brief, the report shows at the end of 1957, that 33,294,900 persons in 1631 communities (870 water supply systems) were being supplied with fluoridated water. During the 12 year period of 1945 to 1957, 94 communities (69 supplies) serving 2,097,955 persons discontinued fluoridation, but of these 69 supplies, 13 of them reinstated fluoridation serving 289,000 persons.

Twelve of the Nation's 18 cities having a population greater than 500,000 now fluoridate their water supplies; of cities with less than half a million population, 32 per cent between 10,000 and 500,000 have fluoridated supplies.

In 82 per cent of the cities where fluoridation is practiced, the governing body authorized fluoridation, in 5 per cent authority was obtained by referendum and in 4 per cent authorization was by commission. Nine per cent of the communities did not report on this subject.

East Lansing, Mich.

found itself with overloaded sludge digesters which created an odor nuisance resulting in complaints from nearby Mich. State Univ. dormitories and apartments. As an emergency measure, the overload on the digesters was relieved by dewatering fresh raw sludge. The problem was so acute that the sewage plant asked for extra fast delivery of the necessary vacuum filtering equipment which was furnished in 45 days by Komline-Sanderson.

Seattle, Washington

now has before it, a $164 million plan for abating the pollution of Lake Washington and Puget Sound. The plan envisages three stages—1960-70, $83 million for facilities both east of Lake Washington and north and south of Seattle along the Sound—1970-80, enlargement of facilities at a cost of $35 million—1980-90, further enlargement of all facilities at a cost of $45 million.

The report was prepared by Brown and Caldwell, Cons. Engrs. of San Francisco, who also presented a plan for $145 million expenditure for storm drain requirements outside Seattle. The program for Step 1 will come to a vote this fall, and indications are that it will receive the voters' approval. The treatment plant will include preaeration screening, grit removal, sedimentation and sludge digestion. The effluent will be discharged 150 ft deep and 3700 ft out in Puget Sound; digested sludge will be pumped 4000 ft into the sound and discharged at a depth of 400 ft.

James G. Weart

Chief Chemist, Illinois Dept. of Health Laboratories, writes: "Your item relative to discolored highballs, on page 221 of your May issue, was of interest to me. Although I am not familiar with the water quality in Utah, it must be similar to that in Illinois. Here with ferruginous waters rather commonly found, the reaction between the iron of the water and the tannin of bonded whiskey produces a vicious looking beverage. Blended whiskey, made with neutral spirits and colored only with caramel, does not produce this effect. This news item is a good illustration of a frequent problem: sanitary engineers should not make like chemists."—Ed. Note. We have previously received a similar comment from N. M. deJarnette of the Georgia Health Dept.—Mr. deJarnette's comment will appear as a filler item at the end of an article.

Pennsylvania

does not intend to discontinue state payments to communities for costs of treatment plants already in operation or under construction. According to Dr. Charles L. Wilber, Jr., State Secretary of Health. The present act provides that municipalities are eligible for annual payment of up to two per cent of the costs of their sewage treatment plants—depending on the amount of available funds appropriated by the legislature for their purpose.

Richard H. Ellis

has retired from his service as Hydrauic Engineer of the Factory Mutual Insurance Co. in Boston and has become associated with the Hydraulic Engineering Section of Metcalf & Eddy, Consulting Engineers in Boston.

15 Years Ago

the FSIWA met in Chicago. There were 614 registrants (less than half as many as this year in Detroit) and the big news was the appointment of W. H. (Pete) Wisely as a full time Executive Secretary-Editor.

Chlorination Practice—Part II	*E. J. Laubusch*
Future Water Demands	*A. H. Gent*
Instrumentation and Control	*W. H. Brown*
Oil Filters at Hunts Point	*R. Riley*
Plastic Pipe	*H. M. McDaniel*
Polyphosphate Treatment	*D. E. Speeg*
Ranney Well Collectors	*H. B. Fehlmann*
Review of 1958 Water & Sewage Process	*Grayson & Hatfield*
Sizing Water Service Piping	*A. Rynders*
Sludge Gas Utilization	*W. P. Pfeiffer*

Plant is located on Ponce de Leon Boulevard, main street of Coral Gables, Florida. Walls are decorated with historic scenes done by famous artist John St. John.

In Coral Gables, Florida . . . . .

modern concrete made this sewage treatment plant a good neighbor

A handsome addition to the city, this plant will cause no loss in property values.

More and more communities like Coral Gables, Florida, are handling the construction of sewage disposal plants the modern way: by building a well-designed, odor-free treatment plant of modern concrete that can be a credit to the community wherever it's located.

Concrete used this way can be beautiful as well as practical. In Coral Gables, the sewage treatment plant is almost a civic show place.

Construction costs with concrete are moderate—and upkeep expense is always low. This is one material that can't rust, rot or burn. It lasts a lifetime. When America builds for beauty . . . it builds with modern concrete.

Write for free literature. Distributed only in the U.S. and Canada.

Engineers, Coral Gables project: Smith and Gillespie, Jacksonville, Florida. Contractor: Markowitz Co., Coral Gables, Florida.

PORTLAND CEMENT ASSOCIATION

Dept. 11-29, 33 W. Grand Ave., Chicago 10, Illinois

A national organization to improve and extend the uses of concrete

MODERN concrete

Equipment News

360° Light Weight Drilling Machine

1101

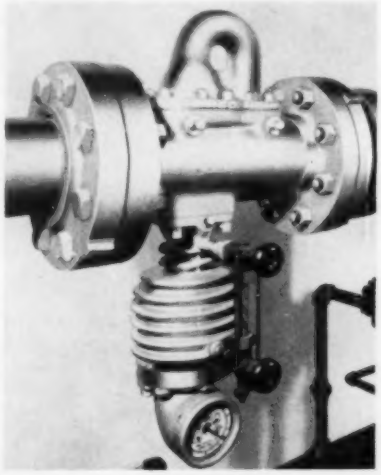
Molco Drilling Machines, Inc., Washington, D. C., has announced a new light weight concrete drilling machine that swivels 360° to allow drilling to any direction.

The swivel action of the new drill greatly increases its versatility and makes it ideal for use in installing conduit, pipe, duct, water line, etc. where many of the drilling operations must be performed in confined or hard-to-reach areas. Using special thin-wall diamond core bits, this mole machine will drill holes as large as 6" in diameter through concrete or any other hard building material at the rate of one inch per minute.

Digester Gas Meter

1102

Builders-Providence, Inc., Div. of B-I-F Industries, Providence, R. I., has available the Shuntflo Meter, for measuring digester gas, that is said to be the lowest cost gas meter for flows above 100 cu ft/hr.



According to the company, this meter features: versatility in sizing; ease of installation requiring no floor space; no daily draining of condensate; low pressure drop—held to any limit specified; corrosion-resistant; freedom from maintenance; remote totalization, recording available with low cost accessories; competely self-contained and self-operated.

Vapor Phase System Provides Steam For Sludge Treatment

1103

Engineering Controls, Inc., St. Louis, Mo., vapor phase system is a trouble-free internal combustion engine cooling method that keeps the engine, or battery of engines, at constant, uniform, most efficient operating temperature at all times, regardless of engine speed or load. This is accomplished by applying the natural law of boiling as the temperature control.

The system recovers all jacket heat plus 50 to 60 per cent of exhaust heat in its most useful form—steam at 0 up to 25 lbs pressure. This steam can then be used for heating, air-conditioning, distillation of sea water, treatment of sewage sludge and many other process applications.

This method of engine cooling also facilitates the use of untreated sewage

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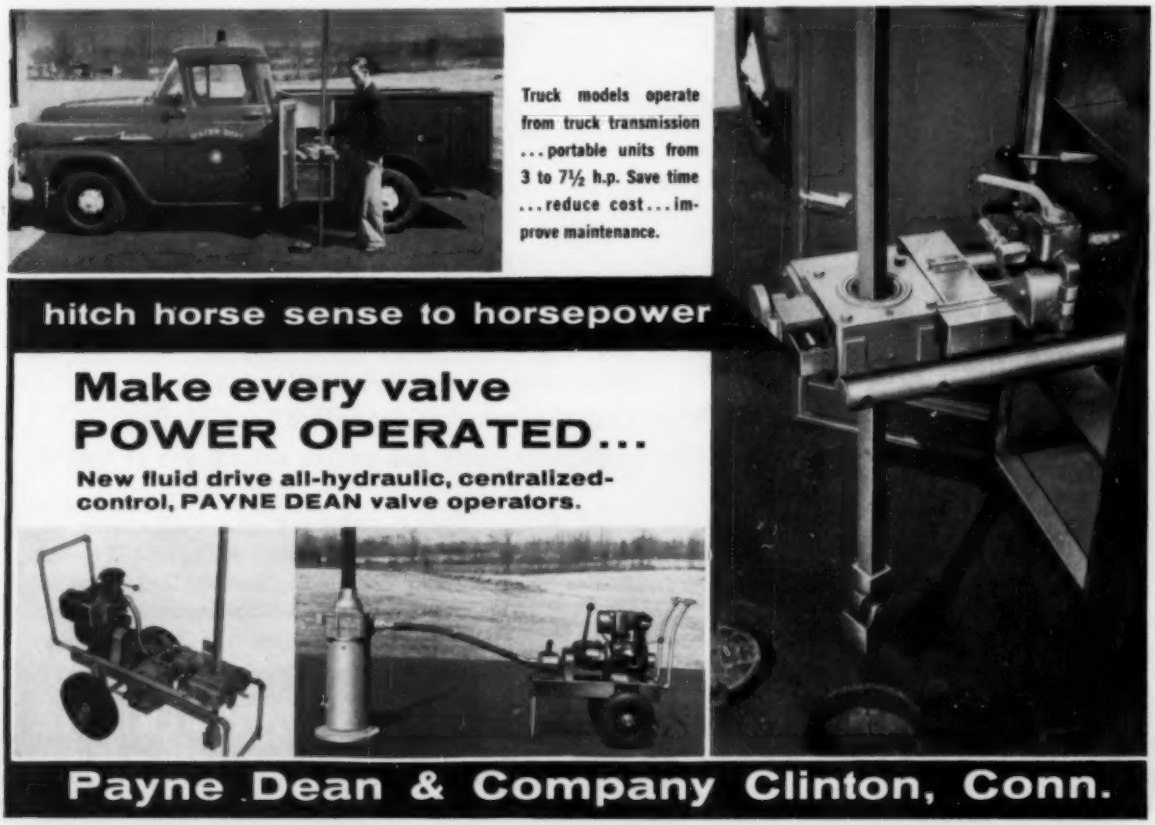
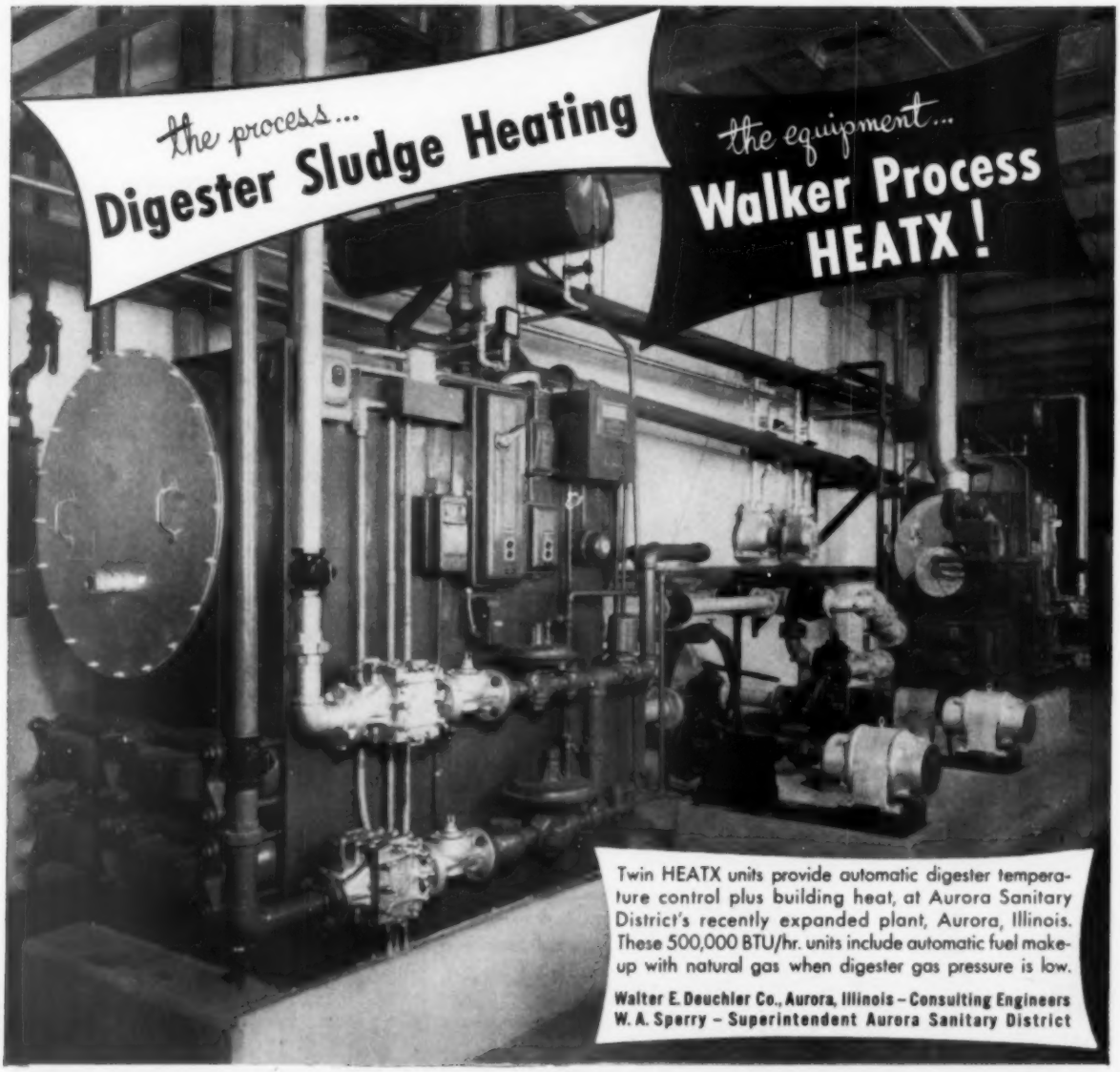

Truck models operate from truck transmission ... portable units from 3 to 7½ h.p. Save time ... reduce cost ... improve maintenance.
hitch horse sense to horsepower
Make every valve POWER OPERATED...
New fluid drive all-hydraulic, centralized-control, PAYNE DEAN valve operators.
Payne Dean & Company Clinton, Conn.



Twin HEATX units provide automatic digester temperature control plus building heat, at Aurora Sanitary District's recently expanded plant, Aurora, Illinois. These 500,000 BTU/hr. units include automatic fuel make-up with natural gas when digester gas pressure is low.

Walter E. Deuchler Co., Aurora, Illinois – Consulting Engineers
W. A. Sperry – Superintendent Aurora Sanitary District

Automatic digester temperature control ■ 180°Boiler heat for building heat

HEATX

140°Exchanger temperature prevents sludge caking
Adaptable to waste heat utilization
Exclusive rifled sludge return bend castings

Maximum efficiency using digester gas and/or natural gas or fuel oil

The Walker Process HEATX provides the *complete unit* for your digester sludge heating process. Concentric tube heat exchanger, fire tube boiler and control panel are combined to give absolute control over each function. Exclusive ***rifled*** sludge return bend castings cause sludge to spiral through the exchanger tubes – better K value – wall scouring prevents slime and grease adhesion. ■ The HEATX is available in standard sizes ranging from 100,000 to 2 million BTU/hr. output. Bulletin 24 S82 gives complete description of type EB (with boiler) and type E (without boiler)

WALKER PROCESS

WALKER PROCESS EQUIPMENT INC.
FACTORY • ENGINEERING OFFICES • LABORATORIES
AURORA, ILLINOIS

Equipment News

CONTINUED FROM PAGE 11A

gas and other fuels containing H_2S or residual fuel oils containing sulphur. Acids from these fuels cannot form due to absence of moisture in the cylinders which are maintained above the dew point (194°F). Also, low water make up requirements reduces supply and treatment problems.

Climatized Vertical Hollow Shaft Motors

1104

The Louis Allis Co., Milwaukee, Wis., recently announced availability of its all-weather Climatized Vertical Hollow Shaft motor in ratings up to 2000 hp.

This motor is designed for indoor and unprotected outdoor service; offers greater compactness for space savings and handling ease, and incorporates the most recent advances in insulating materials. These materials provide optimum resistance to moisture and chemical contaminants, and high mechanical strength for added life.

A maximum of two-high angular bearings are used in the motor to prevent excessive wear and reduced thrust capacity. Water-cooled Kingsbury type thrust bearings are utilized in extra-high thrust applications. For bearing protection the motor has an oil-metering system, sealed bearing chambers and Alnico magnet drain plugs that collect foreign ferrous particles in the oil. Design allows bearing inspection of even the largest motor in five minutes.

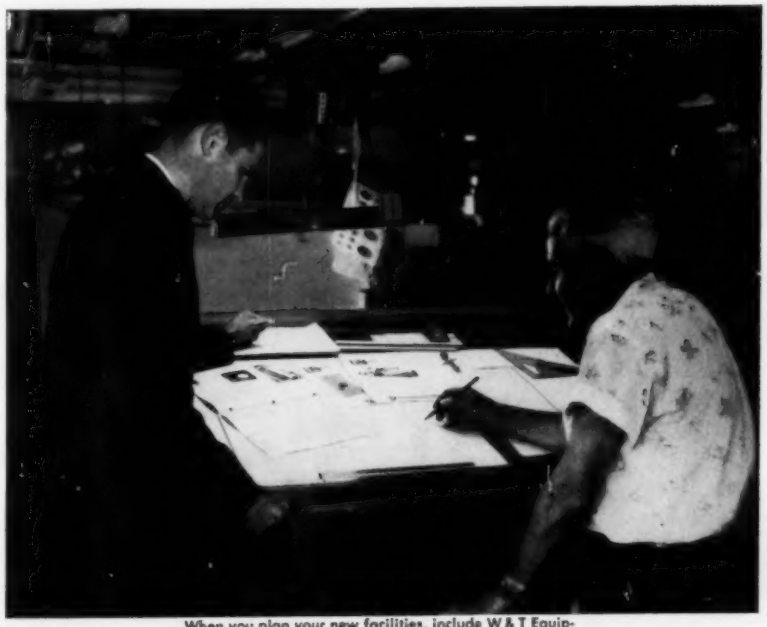
Continuous Wet or Dry Chemical Pumping

1105

Eco Engineering Co., Newark, N. J., has announced a new small chemical pump with carbon gears and bearings, suitable for continuous wet or dry operation in corrosive chemical service.

The new pumps are self-priming and self-lubricating and are available for immediate shipment in 3 gpm and

CONTINUED ON PAGE 15A



When you plan your new facilities, include W & T Equipment, both Chlorinators and Dry Chemical Feeders.

"... this is where we plan to put the W & T Dry Chemical Feeders."

When you plan your new plant or the expansion of your present one, be sure to plan a place for W & T Dry Chemical Feeders as well as Chlorinators. W & T Feeders are used for every type of dry feeding problem found in water and sewage treatment plants.

W & T makes both volumetric (volume measurement) and gravimetric (weight measurement) feeders. There is a feeder for any size job, from small equipment to measure out ounces, to accurate giants capable of handling thousands of pounds per minute.

To find out more about W & T Dry Chemical Feeders, write for bulletin S-124. Or let us know the type of feeder problem you have, so we may send publications describing the W & T equipment best suited for your job.

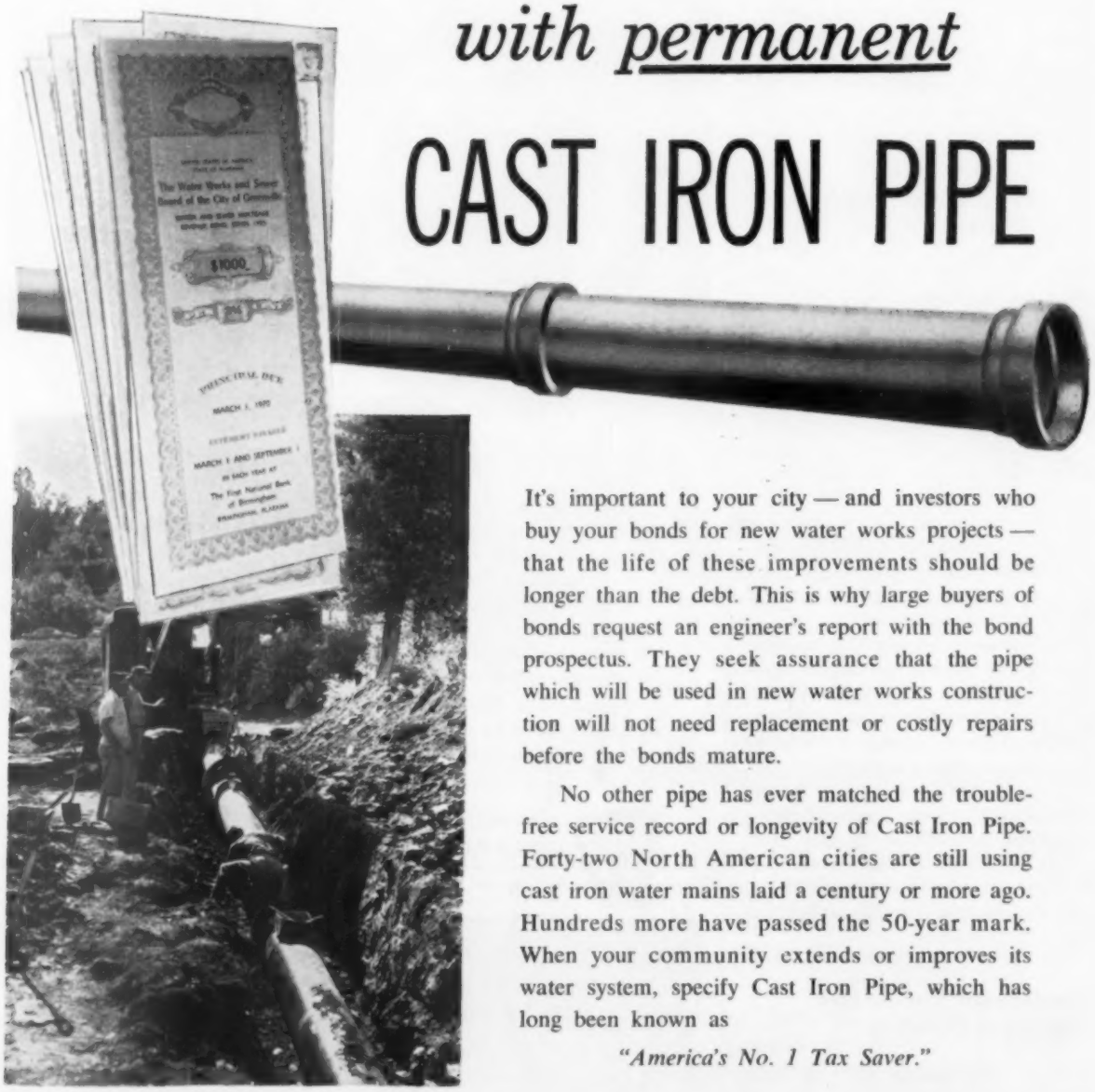
WALLACE & TIERNAN INCORPORATED
25 MAIN STREET, BELLEVILLE 9, NEW JERSEY

E. R. P. CATHODIC PROTECTION
...INDIVIDUALLY DESIGNED FOR EACH APPLICATION
to prevent corrosion of buried or submerged metal structures
Write for Bulletin E-37
E-37

ELECTRO RUST-PROOFING CORPORATION
30 MAIN STREET, BELLEVILLE 9, N. J.

Underwrite Your Bonds for Water Works Improvements with permanent

CAST IRON PIPE


The Water Works and Sewer Board of the City of Gainesville
$1000
MARCH 1, 1955
MARCH 1 AND SEPTEMBER 1
The First National Bank of Birmingham

It's important to your city — and investors who buy your bonds for new water works projects — that the life of these improvements should be longer than the debt. This is why large buyers of bonds request an engineer's report with the bond prospectus. They seek assurance that the pipe which will be used in new water works construction will not need replacement or costly repairs before the bonds mature.

No other pipe has ever matched the trouble-free service record or longevity of Cast Iron Pipe. Forty-two North American cities are still using cast iron water mains laid a century or more ago. Hundreds more have passed the 50-year mark. When your community extends or improves its water system, specify Cast Iron Pipe, which has long been known as

"America's No. 1 Tax Saver."

Our Company does not manufacture Cast Iron Pipe but supplies many of the nation's leading foundries with quality pig iron from which quality pipe is made.

WOODWARD IRON COMPANY

Since 1882

WOODWARD, ALABAMA

Equipment News

CONTINUED FROM PAGE 13A

10 gpm capacities. The carbon bearings are recommended for temperatures to 450°F and speeds to 1800 rpm. Pumps are available in a wide variety of materials including 316 and Type 20 stainless steel, nickel and Hastelloy.

The new pumps are expected to find wide acceptance where intermittent pumping of corrosive or hazardous fluid is required. Previous pumps had extreme limitation in dry or intermittent pumping application due to the bearing and gear material. Carbon gears permit dry running with no overheating.

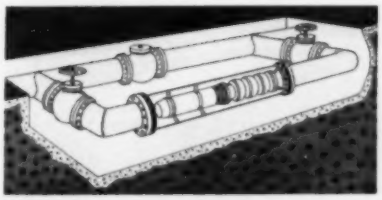
Horizontal "In-Line" Submersible Pump

1106

Layne & Bowler Pump Co., Los Angeles, Calif., has announced their new Submersible Pump for municipal water supplies.

This new pump is specially designed to operate horizontally, rather than vertically, as is customary with other submersible pumps.

The "Power-Line" pump operates as a booster unit, and it fits into a section of the main water pipe, allow-



ing quick and easy removal of the pipe section and pump, if necessary. According to the manufacturer, this new pump, with its unique horizontal operational features, offers high efficiency and affords a substantial pressure increase to the main line.

Addition advantages claimed of this new horizontal submersible concept are that there is no costly pump house to maintain, no additional property to purchase, no more motor damage from heat, dust, and moisture, no possibility of vandalism, and, of course, its quick accessibility to inspection.

Controls for Valve Regulators

1107

Rockwell Mfg. Co., Pittsburgh, Pa., has announced that the complete line of Rockwell-Nordstrom Valve Regulators is now available with Republic Positioners and Controllers — produced by the Company's recently acquired subsidiary, Republic Flow Meters Company of Chicago.

The Rockwell-Nordstrom Valve Regulator, introduced last year, is a pneumatically controlled, cylinder operated lubricated plug valve regulator designed to provide high-pressure large-volume gas regulation with minimum pressure loss.

Introduction of the Republic Controls, which consist of an accurate (vector type) pressure controller and a feed-back type valve positioner, gives the Nordstrom valve greater regulating sensitivity.

Briefly, an increase or decrease of

CONTINUED ON PAGE 19A

The largest water tank repair company in the United States is at your service. Repairs guaranteed for 12 years . . . interior paint guaranteed for 3 years . . . exterior painting guaranteed for 6 years.

Representatives in every state of the Union.

DIXIE TANK'S "SYMBOL" OF YOUR PROTECTION

DIXIE TANK & BRIDGE CO.

3523 LAMAR AVENUE

MAILING ADDRESS: P. O. BOX 14, MEMPHIS 1, TENN.

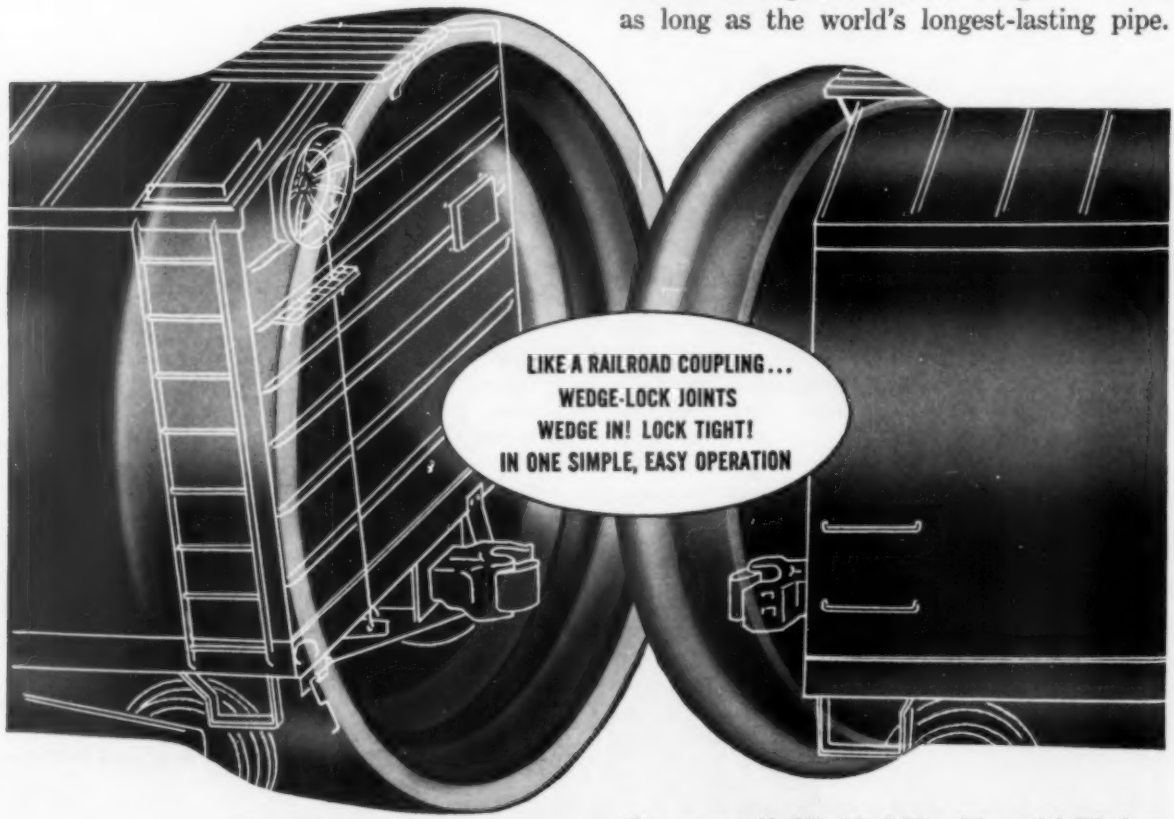
Please write or wire us for more information.

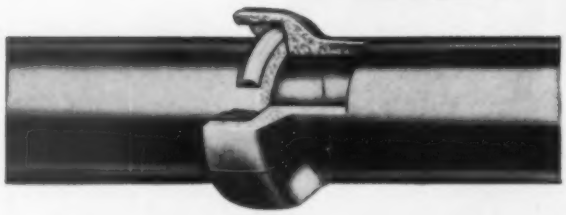
NEW Wedge-Lock* JOINTS

WEDGE IN! LOCK TIGHT!

Stop Infiltration and Roots

Patented Wedge-Lock Joints wedge in and lock tight in one simple, easy operation . . . in continuous compression . . . provide the tightest line . . . stop infiltration and root penetration . . . give easier, faster installation . . . keep installation costs down . . . permit strict adherence to engineered sewer designs . . . last as long as the world's longest-lasting pipe.





Always specify Vitrified Clay Pipe with Wedge-Lock Plastisol Joints.

Write to Listed Manufacturers for literature or an actual Wedge-Lock demonstration.

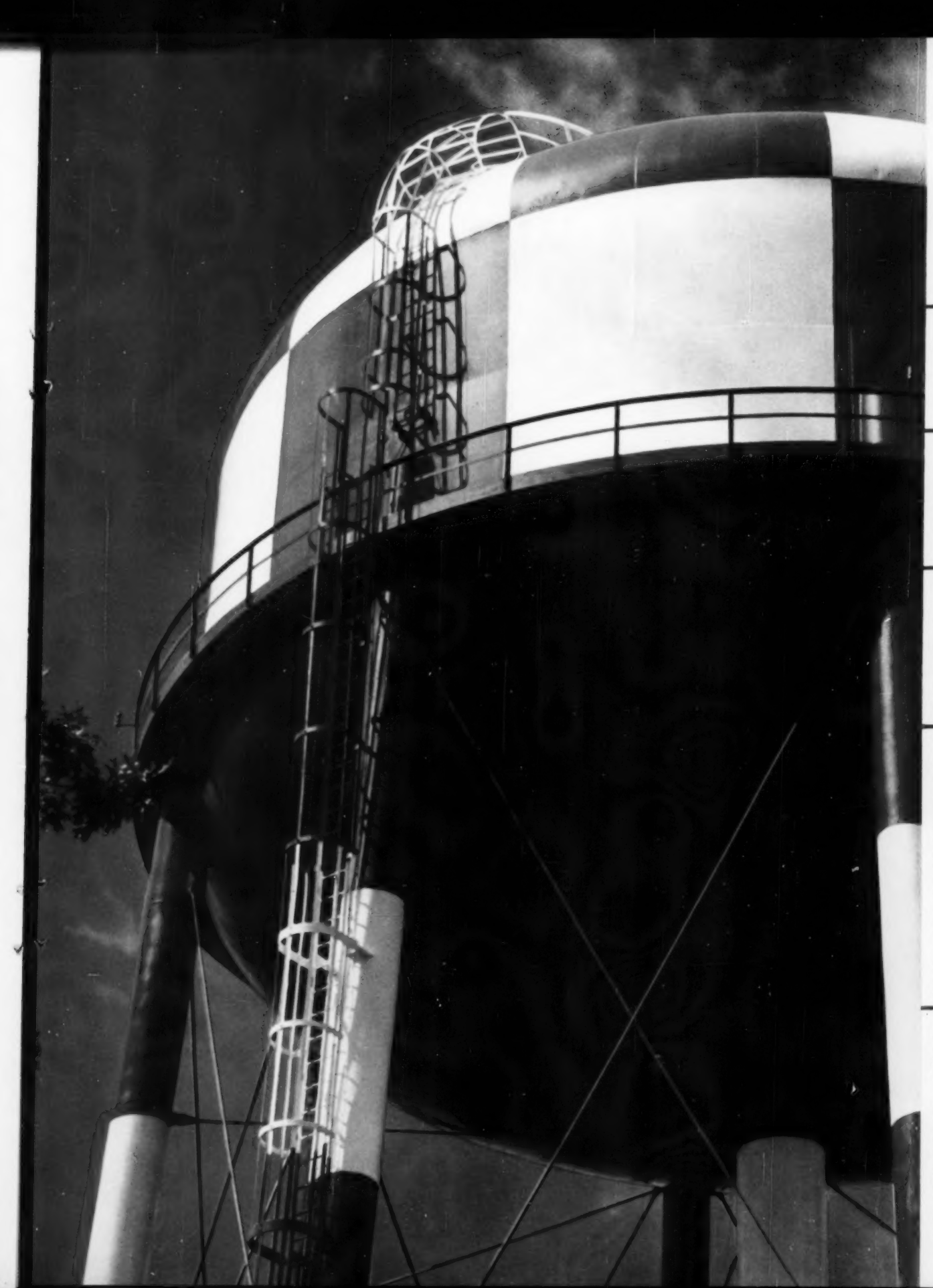
*Patented. T.M. Reg. U.S. Pat. Off.

Wedge-Lock CLAY PIPE

THE FACTORY-JOINTED CLAY PIPE AVAILABLE NATIONALLY FROM LOCAL MANUFACTURERS

Order Wedge-Lock from any of these Vitrified Clay Pipe Manufacturers:

Cannelton Sewer Pipe Company, Cannelton, Ind.
The Evans Pipe Company, Uhrichsville, Ohio
The Logan Clay Products Co., Logan, Ohio
Pacific Clay Products, Los Angeles 54, Calif.
Pomona Terra-Cotta Company, Greensboro, N.C.
Graff-Kittanning Clay Products Division,
The Logan Clay Products Company, Worthington, Pa.
Clay City Pipe Company, Uhrichsville, Ohio
Gladding, McBean & Company, Los Angeles 54, Calif.
(Sold under trade name, "SPEED-SEAL")
Oconee Clay Products Company, Milledgeville, Ga.
Pine Hall Brick & Pipe Company, Winston-Salem, N.C.
The Robinson Clay Product Company, Akron 9, Ohio
Superior Clay Corporation, Uhrichsville, Ohio
The Stillwater Clay Products Company, Cleveland 16, Ohio



FILE REFERENCE

FACT SHEET

GRAVER®

Water Problem Solved for United States Army Fort Meade, Maryland

U. S. Army Engineer District, Baltimore, Md.
In charge of base construction
Benjamin E. Beavin Company
Consulting Engineers, Baltimore, Md.
Ahlquist Bros. Construction Co., Inc.
Contractors, College Park, Md.
Graver Tank & Mfg. Co., Inc.
Design, Fabrication and Erection

Type: Double Ellipsoidal Elevated Tank
Capacity: 600,000 gallons
Height to Overflow: 111′ 6″
Head Range: 38′
Diameter of Tank: 55′
Built to AWWA Specifications
Aircraft warning lights in accordance with CAA regulations
Sterilized and Cathodic Protected

THE PROBLEM

An office building for the Department of Defense, comparable in size to the Pentagon, was completed last year at Fort George G. Meade, Maryland. The resulting influx of thousands of additional people to this military post called for the construction of 1,000 Capehart Housing Units near the office building. A major requirement for this project was the need to provide ample water for domestic use and for fire protection.

THE SOLUTION

The Corps of Engineers, Baltimore District, and the consulting engineers studied the problem and, based on Corps of Engineers criteria for water supply facilities, found that 600,000 gallons of elevated water storage was indicated for the project to meet the demand for present and future water requirements. In addition, a 50′ 3″ diameter by 41′ 6″ high reservoir of carbon steel was erected to supplement the present steel reservoir, with direct pumping facilities to the elevated water tank.

Graver was selected to design, fabricate and erect both the elevated water tank and the reservoir, as well as to provide sterilization, cathodic protection and aircraft warning lights.

The closely integrated cooperation between the Corps of Engineers, Benjamin E. Beavin Company, Ahlquist Bros. and Graver made the solution to the problem an easy one.

It will be to your advantage to discuss your water storage problems with a consulting engineer and Graver, whose mastery in metals is encompassed by a hundred years of experience in tank fabrication and erection.

GRAVER TANK & MFG. CO., INC.

EAST CHICAGO, INDIANA

New York • Philadelphia • Edge Moor, Delaware
Pittsburgh • Atlanta • Detroit • Chicago • Tulsa
Sand Springs, Oklahoma • Houston • New Orleans
Los Angeles • Fontana, California • San Francisco

BUILDING FOR THE FUTURE ON A CENTURY OF CRAFTSMANSHIP IN STEELS AND ALLOYS

GRAVER®

DESIGNED, FABRICATED AND ERECTED BY

RESERVOIRS erected above ground or underground can be designed to store millions of gallons of water.

GRAVER TANK & MFG. CO., INC.

EAST CHICAGO, INDIANA

New York • Philadelphia • Edge Moor, Delaware
Pittsburgh • Atlanta • Detroit • Chicago • Tulsa
Sand Springs, Oklahoma • Houston • New Orleans
Los Angeles • Fontana, California • San Francisco

ELEVATED TANKS, from the smallest to the largest, are skillfully fabricated and erected by Graver's craftsmen.

PUMP SUCTION TANKS ranging in size from 100,000 to 300,000 gallons meet full AWWA specifications.

STANDPIPES are especially designed to provide the static head required.

Select The Tank That Best Solves Your Water Storage Needs

...WE MAKE THEM ALL

GRAVER

A CENTURY OF CRAFTSMANSHIP IN STEELS AND ALLOYS

Equipment News

CONTINUED FROM PAGE 15A

downstream pressure causes a change in the output of the pressure controller, which, in turn, causes the valve positioner to apply pneumatic power to the cylinder operator, thus repositioning the valve and controlling the downstream pressure at the set point.

Plastic Well Casing

1108

Carlon Products Corp., Cleveland, Ohio, has announced an improved plastic well casing for rotary, augur and driven wells. The new product is stronger, yet costs ⅓ less than the company's previous well casing. It is made of an improved high-impact styrene material and is durable and non-toxic.

Named Carlon "T," the well casing is easily installed without mechanical material handling equipment. It is pliable and will follow irregular well holes, even when they are out of plumb. The material can be cut with a handsaw. Permanent joints are made quickly by a two-step solvent weld. The weld is strong enough to be lowered in the well three minutes after cement is applied and sleeve type joints pushed together and twisted. Pumping may begin immediately.

Although light weight, the product will not lose shape after installation. Wall thickness prevents "egging up" to block passage of pumping equipment. Unaffected by the corrosive action of any type of water or soil, the casing will not dent, split or support mold growth.

Blowers Permit Precise Air Volume Regulation

1109

Sutorbilt Corp., Compton, Calif., has announced that guesswork as to the quantity of delivered gas or air has been eliminated by the new "400 Series" of rotary positive pressure blowers. Designed for heavy duty continuous service, these units can be precisely regulated for varying air vol-

CONTINUED ON PAGE 21A

Ferri-Floc
FERRIC SULFATE

Ferri-Floc gives smoother, more efficient and trouble free operation. Whatever your particular water treatment problem may be, you can depend on Ferri-Floc doing a superior job and doing it efficiently and economically—Ferri-Floc is a free flowing granular salt which can be fed with few modifications through any standard dry feed equipment. It is only mildly hygroscopic, thereby permitting easy handling as well as storage in closed hoppers over long periods of time.

The Superior COAGULANT With The Plus FACTORS

WATER TREATMENT

Efficient coagulation of surface or well water. Effective in lime soda-ash softening. Adaptable to treatment of all industrial applications.

SEWAGE TREATMENT

Ferri-Floc coagulates wastes over wide pH ranges—It provides efficient operation regardless of rapid variations of raw sewage—Is effective for conditioning sludge prior to vacuum filtration or drying on sand beds.

TC TENNESSEE CORPORATION

Ferri-Floc
FERRIC SULFATE

SULFUR DIOXIDE SO_2

SULFUR-DIOXIDE is effectively used for dechlorination in water treatment and to remove objectionable odors remaining after purification.

COPPER SULFATE

COPPER SULFATE will control about 90% of the microorganisms normally encountered in water treatment plants more economically than any other chemical.

- Excellent taste and odor control
- Increased filter runs
- Coagulation over wide pH ranges
- Rapid floc formation
- Turbidity removal
- Color removal
- Manganese and Silical removal
- Bacteria removal
- Ease of operation
- Economy

FREE BOOKLET Let us send you without charge, a 38-page booklet that deals specifically with all phases of coagulation—just send us a postal card.

TC TENNESSEE CORPORATION

US RUBBER EXPANSION JOINTS

Drinking heavily for 30 years and still healthy

This U. S. Rubber Expansion Joint has been drinking brackish sea water (at temperatures from 50 to 100 degrees F.) for three decades. It and another identical 36″ U. S. Rubber Expansion Joint are at work on the intake lines of #5 condenser at the Reeves Avenue Power Station of the Virginia Electric & Power Company in Norfolk, Virginia, where they compensate for the vibration, expansion and contraction caused by pumping the sea water. These are two of the first rubber expansion joints ever installed *anywhere*.

U. S. Rubber Expansion Joints are the economical, flexible connections that are used in all kinds of pipe lines to take care of misalignment, vibration, expansion and contraction, and noise transmission. They have no moving parts to wear or bind. They can be installed on both new and old piping and equipment.

• • •

When you think of rubber, think of your "U. S." Distributor. He's your best on-the-spot source of technical aid, quick delivery and quality industrial rubber products.

Mechanical Goods Division

US RUBBER **United States Rubber**

WORLD'S LARGEST MANUFACTURER OF INDUSTRIAL RUBBER PRODUCTS

Rockefeller Center, New York 20, N.Y. In Canada: Dominion Rubber Company, Ltd.

Equipment News

CONTINUED FROM PAGE 19A

umes simply by changing blower speeds.

Operating at a constant speed against a constant pressure, the blower always delivers constant volume of air. Increasing the blower speed against the constant pressure increases air volume by an amount equal to the blower's displacement times the increased number of revolutions. Blower speed is increased by means of pulley changes or variable speed drive adjustment.

The new 400 Series rotary blowers deliver air volume up to 13,000 cfm and pressures up to 10 psi and are available in 30 sizes ranging from displacements of one and one-half to forty cubic feet. For high pressures, double staging is suggested for maximum efficiency.

Flange Mounted Drive

1110

The Falk Corp., Milwaukee, Wis., has developed a compact gear drive that bolts directly to the driven machine. The unit is designed with bearing capacities for overhung and thrust loads to allow installation of this drive into the driven machine as a geared pillow block, if desired. Thus it is possible to eliminate one machine bearing and cut down the overall size of the installation.

Falk Flange Mounted Drives are built to American Gear Manufacturers Association recommendations and are available for horizontal or for vertical applications, with high speed shaft up or down. These rugged units are furnished from stock in single reduction for applications of ½-10 hp, and in two double reduction ratios for ½-5 hp.

Pipe Cutter

1111

Beaver Pipe Tools, Inc., Warren, Ohio, has recently introduced a new non-Spiral Clear Vue Cutter to the market.

The new Beaver cutter has extra

CONTINUED ON PAGE 22A

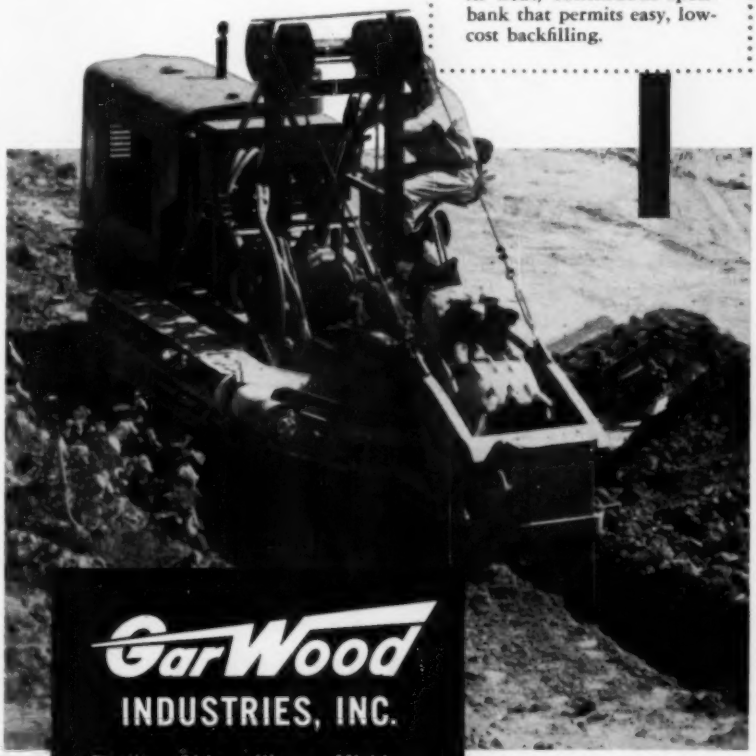
The Buckeye 307 digs CLEAN, LOW-COST DITCH

With the Gar Wood-Buckeye 307 ditcher, you'll do more than dig fast! Advanced "307" control system assures *cleaner* ditch that requires little or no hand-finishing. Here's why:

Grouped "307" controls simplify operation. For accuracy of depth and grade, hydraulic wheel hoist lets operator make on-the-go adjustments with one hand. "Live", independent control means greatest precision, fewer delays. And, hydraulic conveyor drive has 3 speeds in either direction. Offers instantaneous control to handle any volume of spoil—*independent* of digging wheel or travel speeds.

Learn all about the "307" and how it can dig lower cost ditch for *you!* Contact your Gar Wood-Buckeye dealer or write to: Customer Service Dept., Gar Wood Industries, Inc., Wayne, Michigan.

This owner lays 400% more pipe per day since replacing a backhoe with the Buckeye 307. He praises the 307 for its neat, continuous spoil-bank that permits easy, low-cost backfilling.



Gar Wood
INDUSTRIES, INC.
Findlay, Ohio • Wayne, Michigan

Equipment News

CONTINUED FROM PAGE 21A

wide rollers to prevent spiraling. It cuts ⅛ to 2-inch material. It is for hand or power drive use; thus one tool does the work of two tools. The position of the wheel gives the "clear view" that permits quick and accurate setting to mark. Fast and easy cuts are created because the pressure is applied directly to the cutter wheel for fast easy cutting. Uses the Beaver Honded-Edge Black Magic Cutter Wheel.

Butterfly Valves

1112

Mason-Neilan, a Division of Worthington Corp., Norwood, Mass., has announced that major advances in Butterfly Valve design have been incorporated in the new 32,000 series of wafer-type butterfly valves, now being offered.

Outstanding features of the new Butterfly Valve line are said to be ruggedized actuator mounting, ease of adjustment, accessibility and maximum actuator power delivery. A special actuator mounting plate has been designed which provides maximum

support and makes it possible for the actuator to be adjusted along a slotted plate so that actuator may be precisely positioned to deliver maximum power with minimum angularity. This enables the connecting stem and link to be in line and at right angles to shaft arm at mid-stroke, for either 60° or 90° (or any intermediate point) operation.

New Shut-Off Valve

1113

Rene Mfg. Co., Minneapolis, Minn., has announced that nuisance leaks are prevented and maintenance costs reduced by the unique design of a new shut-off valve whose patented action insures positive closure despite heavy usage.

Secret of the Rene valve is a neoprene ball which, when the stem is retracted, is forced against a beveled seat by fluid inlet pressure to form a positive seal against leakage. When the valve is open (turning the stem counter clockwise unseats the ball), the ball floats free but remains axially aligned with its seat. Reverse stem

CONTINUED ON PAGE 26A

Stop costly infiltration in storm drains and sewer lines with the famous

CENTRILINE PROCESS

Centrilining is effective in diameters from 6" to 144"

The Centriline Process of centrifugally applying a cement-mortar lining to pipes in place can be as effective in preventing infiltration in sewer and storm lines caused by external pressures as it is in permanently eliminating leakage in water mains caused by interior pressures and corrosion. Infiltration means over-taxed pipe line capacity and higher costs for treatment and disposal. Infiltration also results in the settlement of streets and other surfaces. Centriline's 6 million feet of pipe rehabilitation experience is on call to help with these problems.

Lining is placed when infiltration has been stopped by natural lowering of water table, plugging leaks from the interior, or by well pointing. A qualified Centriline engineer will be happy to discuss our quick and economical method of repairing concrete and terra cotta storm drains and sewer lines in sizes from 6" to 144". For further information, write today for your copy of our free booklet which fully describes the Centriline Process.

CENTRILINE CORPORATION

A Subsidiary of Raymond International Inc.

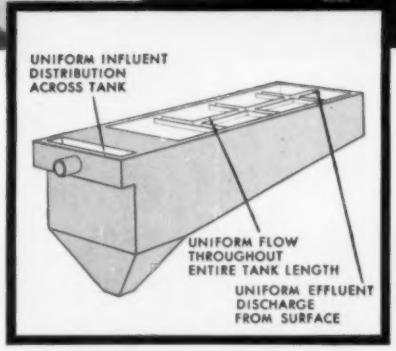
140 Cedar Street
New York 6, N. Y.
WOrth 2-1429

Branch Offices in Principal Cities of the United States, Canada and Latin America.

Link-Belt Uniflow settling tank matches efficiency of conventional tanks in

25% less detention time

UNIFLOW AT WORK. Modern sewage treatment system uses Link-Belt Straightline collectors in Uniflow settling tanks. Structural aspects of Uniflow design make possible the use of conventional equipment, give flexibility of layout to accommodate site characteristics. Here operator tilts Link-Belt Rotoline scum pipe.


UNIFORM INFLUENT DISTRIBUTION ACROSS TANK
UNIFORM FLOW THROUGHOUT ENTIRE TANK LENGTH
UNIFORM EFFLUENT DISCHARGE FROM SURFACE

Uniflow with same overflow rate as conventional tank costs less to construct

Combining a rapidly sloping bottom with a system of multiple weirs, Link-Belt Uniflow tank design increases the efficiency of solids removal from water, sewage or industrial liquids. Removal efficiency depends on overflow rate and not upon the depth of the basin. With Uniflow's sloping bottom design, tank volume is reduced as much as 25% while the surface area and resultant overflow rate remain equal to that of conventional tanks. You realize greater efficiency, lower construction and concrete costs.

We will be glad to work with your engineers, chemists and consultants. Ask your nearest Link-Belt office for Folder 2648 containing selection charts, construction details and specifications.

LINK-BELT

SANITARY ENGINEERING EQUIPMENT

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. Sanitary Engineering Regional Offices—Colmar, Pa., Chicago 9, Kansas City 8, Mo., San Francisco 24. Sales Offices in All Principal Cities. Export Office, New York 7. Representatives Throughout the World. 14,788

Allis-Chalmers equipment

Motors—Sizes used range from 300 hp to 700 hp. There are also two 1000-hp and two 900-hp hollow-shaft motors.

Motor Control—A-C motor control was used throughout. Shown is one group of Allis-Chalmers high voltage starters.

A-C ALLIS-CHALMERS

A-5787

powers gigantic

do-it-yourself
WATER PROJECT

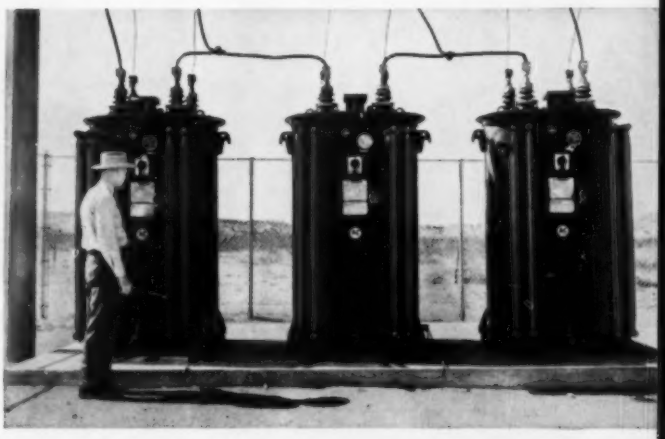
Water from man-made lake pumped to users in seven Texas counties

Down in Texas, where the unusual is commonplace, there's a man-made lake—with oil wells popping up from its surface! Texas—where oil flows like water, but flowing water is scarce — saw the creation of what is probably the world's largest do-it-yourself public works project. Lake J. B. Thomas was formed from the waters of the Colorado River, flooding an 8000-acre area.

The cities of Odessa, Big Spring and Snyder created a water district under State laws, and solved their serious water problem by the sale of revenue bonds, without any tax liability or Federal assistance. Ten billion gallons of water annually serve domestic and industrial customers and three oil well repressuring operations spread over seven counties.

More than 200 pieces of Allis-Chalmers equipment — motors, pumps, control and transformers—pump 36 million gallons of water daily through the two main pumping stations and booster stations along the 111 miles of pipelines. Multi-product engineering skills, normally calling for several manufacturers, are thus conveniently obtained from a single source.

Many progressive cities are benefiting from Allis-Chalmers range of products and all-around public works experience. *Your* city can, too. Call your nearest A-C office, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wis.

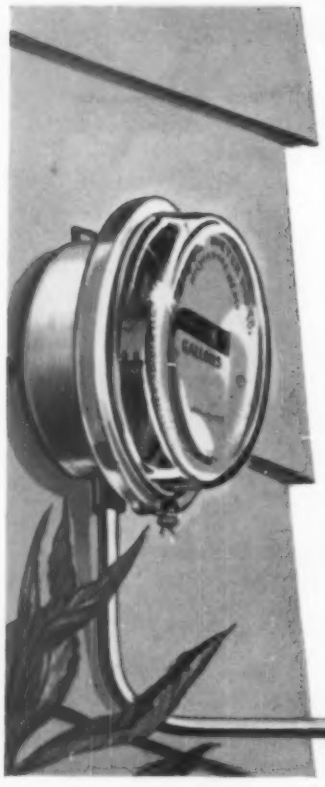


Pumps—Twenty-two pumps of various sizes are located at main pumping stations and booster stations along the 111-mile pipeline.

Transformers — 132 transformers, ranging in all sizes, distribute the power necessary to operate the equipment.

Allis-Chalmers public works equipment — Motor-generators, pumps, compressors, condensers, blowers, hydraulic turbines and generators, motors, transformers, switchgear, butterfly valves, diesel engines.

ALLIS-CHALMERS



New! BADGER Read-o-Matic* REGISTER

adds speed-reading to water metering

Here is the industry's first practical outdoor register — the Badger Read-o-Matic. Now meter reading routes can be completed in half the time — with no more wasted calls. Plus other important benefits such as:

• *No more "lockouts"* • *No more in-house accidents* • *No more access problems* • *No more inconvenienced customers*

The new Badger Read-o-Matic means a modern meter reading system that your water department can have now — and opens a whole new realm of possibilities for the future. You'll want to read about them in our free new Badger Read-o-Matic folder.

*Pat. applied for in U. S. A. and foreign countries

Badger Meter Mfg. Co. • 4545 W. Brown Deer Rd. • Milwaukee 18, Wis.

• For further information on products or services please use reader service card.

Equipment News

CONTINUED FROM PAGE 22A

threads permit conventional operation of the valve.

Minimum effort is required to open the valve because incoming pressure helps move the ball from its seat once the initial flow is established. Stem leakage is eliminated by an O-ring seal.

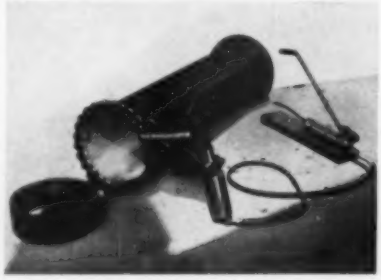
Rotation of the ball causes a self-cleaning action that minimizes corrosion and collection of sediment within the cage and on the valve seat, thereby reducing maintenance costs by eliminating seat replacements and/or regrinding. This rotation also limits surface wear on the ball by providing and infinite number of seat surfaces.

New Hydraulic Pipe Cutter

1114

Wheeler Mfg. Corp., Ashtabula, Ohio, has developed a new, heavy-duty hydraulic pipe cutter.

The Hydraulic Cutter, according to the manufacturer, will cut cast iron water main or cement-lined cast iron water from 4″ to 12″, standard or extra-heavy soil pipe from 6″ through 15″, terra cotta or clay tile from 6″ through 36″, and transite pressure pipe from 6″ through 10″.



To operate, the chain is wrapped around the pipe and pulled through the jaws to the nearest ring. Adjusting screw is tightened to take up the slack and hydraulic pressure applied by hand or electric pump. Operator gets a clean, accurate cut in less than one minute.

The manufacturer states that the Hydraulic Cutter requires no vice or turning-can cut pipe in a ditch, in a line, or anywhere that the chain can be wrapped around the pipe.

A New Sewer Pipe System Classification

1115

Keasbey & Mattison Company, Ambler, Pa., has announced a new system of engineering classifications for its asbestos-cement gravity sewer pipe. These new classifications are intended to be descriptive of the pipe's ability to withstand trench loads and make the design engineer's job easier by furnishing him with pipe of various crushing strengths.

For example, Class 1500 means that each pipe is able to sustain a minimum crushing load of 1500 pounds per lineal foot without failure when tested by the standard "Three-edge bearing method." The new engineering classifications are available in Class 1500, 2400, 3300, 4000 and 5000 and allows a greater degree of latitude in design than ever before possible.

These classifications, however, represent minimum crushing valves

which can be appreciably increased by various methods of trench bedding.

With the new classification system, the sanitary engineer is able to select asbestos-cement pipe to meet specific field conditions allowing him a greater margin of safety with maximum economy.

Flow Rate Transmitter

1116

Brooks Rotameter Co., Lansdale, Pa., has announced that the Brooks MPT-50 pneumatic flow rate transmitter is a completely new instrument using unusual design innovations.

This instrument uses a magnetic method to convert, with complete fidelity, the long linear motion of a rotameter metering float—in fact, any linear motion—into a rotary motion for flow rate indication, transmission, or alarm. False or ambiguous response or readings are totally eliminated.

This new design approach to eliminate the shortcomings of previous rotameter flow transmitters, consists of a magnetic iron strip formed into a helix and encapsulated in a non-magnetic stainless steel tube which floats between two stainless steel, miniature bearing races. The helix assembly is located parallel and adjacent to a stainless steel rotameter extension tube. A metering float extension which has a small magnet embedded in it moves within the tube in direct response to flow rate changes. The leading edge of the helix is constantly attracted to the magnet, thus turning to convert a linear motion into a rotary one. Its action is analogous to that of a rack and pinon. A pointer mounted on top of the helix assembly indicates flow rate.

Hydraulically Operated Sideboom

1117

Midwestern Mfg. Co., Tulsa, Oklahoma, has announced a new addition to their line of hydraulically operated sidebooms for small crawler tractors.

The new Midwestern model is designed for attachment to the Case-Terratrac Model 600 industrial crawler tractor with 60″ gauge tracks. It will handle up to 12″ pipe with a lifting capacity up to 10,000 lbs.

The new sideboom employs the same hydraulic features that are used throughout the line, and it also utilizes the newly designed double cable drum arrangement.

Counter-Rotating Terramatic Transmission plus Torque Converter Terramatic Drive provides this tractor-sideboom combination with exceptional maneuverability and fast, accurate pipe positioning.

Lining Steel Surfaces With Polyethylene

1118

Tank Lining Corp., Pittsburgh, Pa., has developed what it believes will be the first commercially successful method of applying pure polyethylene to steel surfaces as a lining material for tanks, pipe and valves.

Polyethylene is known to have excellent resistance to the corrosive attack of many chemicals, but previous attempts to coat chemical-containing vessels with the wonder plastic have met with very limited success. Systems of flame spraying polyethylene have managed to stick the plastic to steel, but the plastic itself lost many of its desirable qualities in the process and often broken down under use. Dip methods of applying polyethylene

CONTINUED ON PAGE 29A

Here's the big news behind the industry's first practical outdoor register

The Badger Read-o-Matic is powered entirely by the meter to which it is attached . . . works on an exclusive "pulse" principle. As water flows through the meter, the generator sends a pulse by wire to the Badger Read-o-Matic register outside for accurate recording.

Like our Badger meters, the Badger Read-o-Matic is precision-engineered — thoroughly tested by our trained water meter experts in the laboratory and in the field. Badger Meter products are the result of over 50 years of *specialized* water meter experience — products that excel around the world in accuracy, durability, dependability and low maintenance cost.

Send for free, colorful brochure that tells you all about the revolutionary Badger Read-o-Matic. For an actual demonstration, see your Badger representative or write us direct.

Badger Water Meters

Badger Meter Mfg. Co. • 4545 W. Brown Deer Rd. • Milwaukee 18, Wis.

All internal parts, including the drain valve seat, are drawn through the top of the hydrant without disturbing the standpipe.

We can show you – right in your office – why Mathews dry-head construction is so important

No community can afford to take chances with its hydrants. They *have* to work—not just when they're new, but in every single emergency during the course of a long, long life. That's why the dry-head construction of the Mathews Flange Barrel Hydrant is so significant. It keeps sand and ice and sediment from accumulating and interfering with its instantaneous operation, a feature that can be highly important.

We can actually show you what we mean without even asking you to get up out of your chair. We'll bring our scale model to your office and disassemble it so that you can see its inner workings. Why not write us today and ask for one of our representatives to show you these important features.

Made by

R. D. WOOD COMPANY

Public Ledger Building, Independence Square, Philadelphia 5, Pa.

Manufacturers of Mathews Hydrants and "Sand-Spun" Pipe (centrifugally cast in sand molds)

New Equipment

CONTINUED FROM PAGE 27A

have been successful for small pieces, but are impractical for large tanks.

Tank Lining's new method involves a very special preparation of the steel surface and the spraying on of a previously prepared high molecular weight, high density, low pressure type polyethylene, followed by a carefully controlled heat treating process.

Valve For Gauge Or Metering Service

1119

Kerotest Mfg. Co., Pittsburgh, Pa., has developed a new globe type needle valve for use as a gauge or for metering service in gas, oil, water lines, or other similar uses. It has been developed to provide a high-quality, economical valve for applications where space is a factor and where operating areas are close meter boxes, pressure gauge controls, laboratories, sampling valves, or other uses where a high-pressure, accurately controlled, perfect shut-off valve is required.

The new valve features a one-piece solid forged carbon steel body with a 12/14 chromium heat-treated stainless steel stem with a Teflon packing. It is available in sizes of ⅛, ¼, ⅜, and ½ inches. It has a maximum working pressure of 10,000 psi at 70 degrees F, and a maximum operating temperature of 500 degrees.

High Strength/Temperature Plastic Pipe

1120

Carlon Products Corp., Cleveland, Ohio, has developed a new rigid plastic pipe which can be used at high operating pressures and temperatures than any other thermoplastic plastic pipe.

The new HTHT pipe is made from an improved Kralastic resin developed by United States Rubber Company. This new resin, with Carlon's special production methods and quality control, makes the new HTHT the first plastic pipe which can be used at temperatures as high as 180° F with

CONTINUED ON PAGE 30A

Put trench spoil off the road —the 80W will pull it back

Keep traffic lanes clear, put your spoil off the pavement. The Cleveland 80W backfiller pulls spoil from opposite side of trench, backfills *toward* itself, works parallel to trench and to traffic.

As it backfills, the 80W simultaneously compacts fill, the right way, from the bottom up. Leaves no voids around pipe—no settling, now *or* later.

Result: a clean, safe, *completed* job.

The 80W backfills *away from* itself, too. Stays off lawns, sidewalks and completed work.

Fits *all* job conditions.

The CLEVELAND TRENCHER Co.

20100 ST. CLAIR AVE. • CLEVELAND 17, OHIO

Good Everywhere

Equipment News

CONTINUED FROM PAGE 29A

tensile strength which allows working pressure ratings averaging 100 psi above other rigid plastic pipe of the same IPS size. Higher working pressure ratings mean that pressure-rated sizes will be lower in cost than existing Kralastic pipes.

Mechanical Sludge Thickener

1121

Sonic Separation, Inc., Lake Hiawatha, N. J., has available the Heymann sludge thickener, a mechanical sludge process depending primarily on a vibration principle. The thickener changes the physical structure of the sludge, and avoids the use of chemicals, heat or additives, eliminates digesters and lagoons, and minimizes the necessity of sand beds.

The process involves passing raw or digested sludge over a vibration screen and through a roller press, resulting in a final total solids content of 26 to 35 per cent and almost complete elimination of odor.

The sludge is introduced on the inlet end of the vibrating screen by gravity from a holding tank or by pump. The screen is equipped with combs spaced at intervals to regulate the detention of the sludge on the vibrator. The sludge is transported slowly across the vibrator while moisture is removed through filtrate lines from the bottom of the screen. Following the vibrator the sludge is passed through a roller press in which additional moisture is removed. The roller press may also be vibrated to facilitate additional moisture removal.

. . . for DOUBLE SAVINGS

The FORD COPPERHORN

The Ford Copperhorn for vertical lines provides TWO important savings . . . . first in original settings and then, later, whenever changes or replacements are necessary.

At the time of the initial setting, only two pipe fittings are required, one above and one below. These fittings are not disturbed when meters are changed . . . . all that is necessary is a few quick turns of the meter coupling nuts and the job is done.

WRITE FOR CATALOG

Write today for full information and the complete Ford catalog No. 56—FREE.

THE FORD METER BOX COMPANY, INC.

FOR BETTER WATER SERVICES

FORD

Wabash, Indiana

Pipe Couplers For All Pressure Joint Pipe

1122

The E. H. Wachs Co., Chicago, Ill., has developed a new single unit pipe coupling machine for cement-asbestos, concrete, clay or cast iron Pressure Joint Pipe.

This new Compound Leverage Coupler saves time as well as labor and pulls the pipe all the way home for a bottle tight, positive seal. Unit sets on top of pipe and is clamped in position with a single action lever. No chains, cables or pulleys—nothing to pass under pipe.

The manufacturer claims that these new Pipe Couplers make it possible for pipe laying crews to actually keep up with ditching machines.

New "Wedge-Seal" Gate Valve

1123

Hamer Valves, Inc., Long Beach, Calif., has announced a new leakproof gate valve which incorporates Teflon Seals in the wedge.

CONTINUED ON PAGE 39A

NOW . . . a drilling and tapping machine

designed for

POWER

or **HAND**

operation

the NEW MUELLER® B-100

Now you can drill and tap with power! *Now* you can choose air or electric drive units. *Now* you can reverse and withdraw under power. Yes, these new features and many more are yours in the Mueller B-100 Drilling and Tapping Machine.

Power feed during drilling operation is automatic – drill is not crowded, assuring longer tool life. Feed yoke, easily disengaged, permits tapping under power.

Ask your Mueller Representative, or write direct for complete information.

MUELLER CO. since 1857 SERVING the Water and Gas Industries QUALITY

MUELLER CO.

DECATUR, ILL.

Factories at: Decatur, Chattanooga, Los Angeles; In Canada: Mueller, Limited, Sarnia, Ontario

savings have helped us absorb in labor and material costs..."

Crews of Fanning and Doorley Construction Co. installing 8" line in Providence, R. I.

3. Operation. Here's where Transite really saves! For its maintained carrying capacity keeps pumping costs low year after year. Its strength, durability and corrosion resistance cut maintenance to a minimum, provide years of trouble-free service.

Transite's Ring-Tite Coupling cut away to show how rubber rings are compressed and locked in place to form a tight yet flexible joint.

We'll be pleased to send you booklet TR-160A. Write Johns-Manville, WS Box 14, N. Y. 16, N. Y.

"Good Water, the Lifeblood of your Community" Let's promote it—Let's have it!

JOHNS-MANVILLE

100 YEARS OF QUALITY PRODUCTS . . . 1858—1958

JOHNS-MANVILLE JM PRODUCTS

"Transite's installation recent increases

Says Philip J. Holton, Jr.
Chief Engineer
Water Supply Board
Providence, R.I.

"Our records show that labor and material costs have increased 100% since 1946. Yet, in this same period of time, our installation costs have increased only 21%. The ease of handling and speed with which contractors can lay Transite Pipe enable us to take full advantage of modern equipment and methods. In this way, Transite has played a prominent part in helping us offset increased costs."

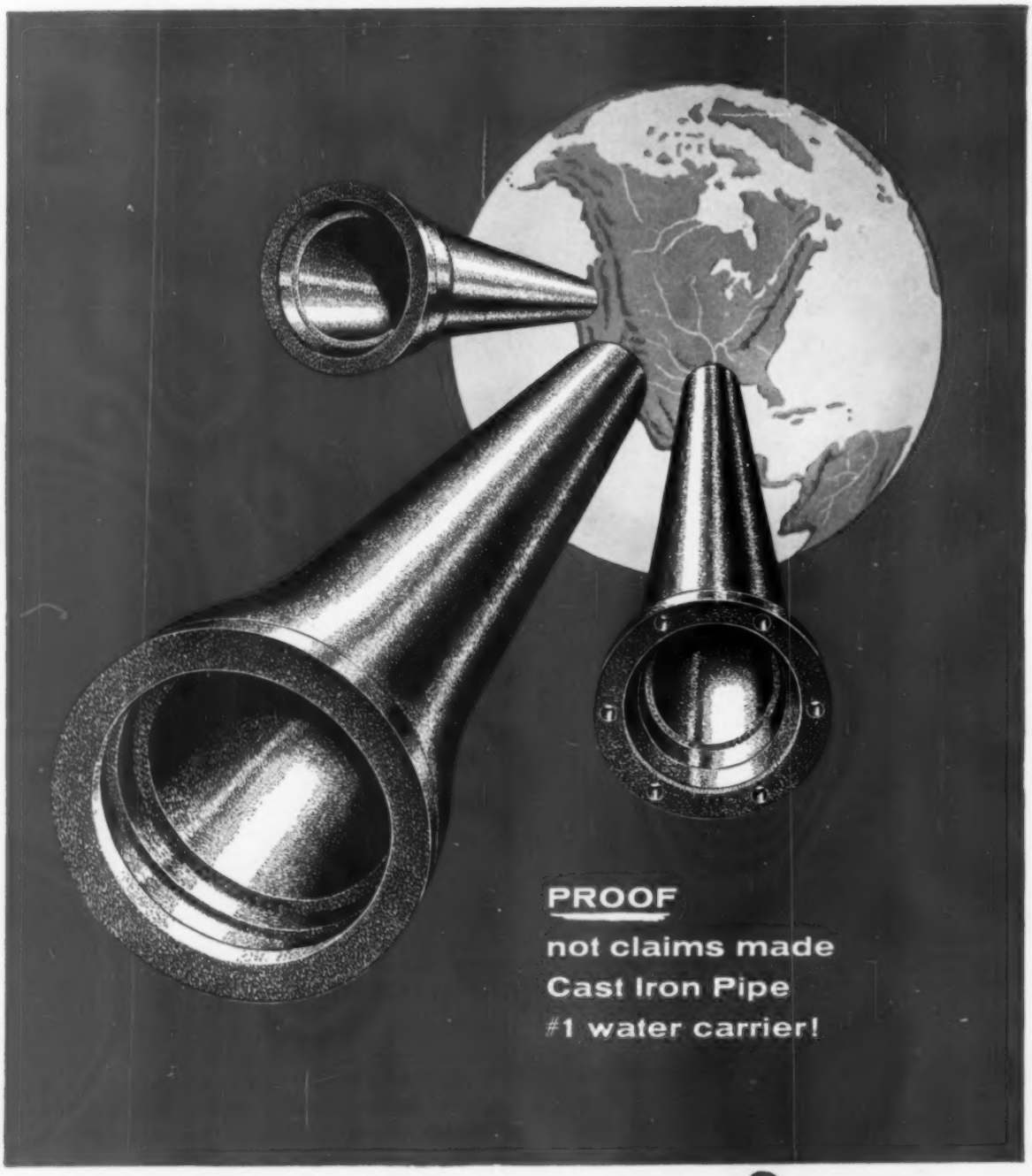
Transite Pressure Pipe helps you cut system costs 3 ways: in design . . . installation . . . operation!

Today, in every part of the nation, municipal and consulting engineers choose Transite® Pressure Pipe. Ask why, and you find that economy is always among the Transite advantages they consider most important. For no pipe does so much to help keep your costs low in three different areas:

1. Design. Transite lets you plan a system for maximum efficiency. For its high carrying capacity (flow coefficient, C=140) often lets you specify pipe of smaller diameter. And because Transite's smooth interior remains smooth, you never need to make costly allowances for future reduction in carrying capacity.

2. Installation. Transite's installation speed cuts time and labor costs substantially. Light in weight for so durable a pipe, it handles easily above and below ground. And its Ring-Tite Coupling assembles quickly, surely . . . giving you a tight seal at every coupling in the system.

TAKE THE DOUBT



MODERNIZED **cast iron**

OUT OF PIPE BUYING

Specify Modernized Cast Iron Pipe and be SURE!

6 reasons why Cast Iron Pipe is #1 choice of U.S.A.

1. **EXTERNAL LOAD RESISTANCE...**
   6" Class 150 Pipe withstands a crushing load of 17,900 pounds per foot . . . nearly 9 tons.
2. **HIGH FLOW CAPACITY...**
   Cement lined cast iron pipe and fittings will not tuberculate . . . delivers a full flow for the life of the pipe.
3. **LONG LIFE...**
   42 North American cities are still using cast iron water mains laid 100 years and more ago. Hundreds more have passed the 50 year mark.
4. **BEAM STRENGTH...**
   Cast Iron Pipe is inherently tough . . . stands up under heavy traffic load, soil displacement and disturbance.
5. **CORROSION RESISTANCE...**
   Cast Iron Pipe effectively resists corrosion . . . vital factor in its long life and dependability.
6. **TIGHT JOINTS...**
   A full range of leak-proof, low cost, easy-to-assemble joints for pipe and fittings are available for all conditions.

Before you choose any pipe remember this important fact . . . it will save you many a headache later.

In all the history of water systems no substitute pipe has ever come close to matching cast iron pipe's century old record of dependability, long life and long term economy.

Specify cast iron pipe, and your pipe worries are over, not just beginning. Cast iron's performance is based on PROOF not claims!

THE MAN WHO CHOOSES CAST IRON PIPE TODAY WON'T PAY FOR IT AGAIN TOMORROW!

CAST IRON

Cast Iron Pipe Research Association
Thos. F. Wolfe, Managing Director
Suite 3440, Prudential Plaza, Chicago 1, Ill.

pipe FOR MODERN WATER WORKS

View from pump floor in Oswego, New York, pumping station showing one of main pumps being driven by Westinghouse 300-hp vertical synchronous motor above.

Robert B. Stannard, Resident Engineer for Nussbaumer, Clarke and Velzy, Consulting Engineers; Karr Parker, Jr., Buffalo Electric Co.; Kenneth D. Jensen, Superintendent, Department of Water, Oswego; and M. B. Trimble, Westinghouse Construction Sales Engineer, discuss "tilt-out, lock-out" feature of the control center. Westinghouse double-ended control power center has 300-kva Inerteen® transformer at each end.

Oswego water pumping station Powers-Up to attract new industries

The modernization and expansion program of the Department of Water, Oswego, N. Y., provides an interesting example of building today for tomorrow's needs. While planning for today, Oswego's Water Board recognized that a good water supply is an indispensable commodity in attracting new industry to the area. By Powering-Up electrically, their new pumping station has electrical capacity five times present demand to allow for future growth.

Present demands for water are approximately 10 million gallons per day. Installed pumping capacity is capable of providing more than 20 million gallons per day. In addition, provision has been made to increase capacity to 35 million gallons per day when required by future demands.

The new pumping station is supplied with lake water from an intake tunnel which extends through solid rock for a distance of 6250 feet into Lake Ontario. This tunnel intake averages eight feet in diameter and is capable of conveying 128 million gallons of water per day.

Electrical power for the station is available from two separate sources—one direct from the Oswego Steam Station and the other from the Niagara-Mohawk Varick Station. The complete electric distribution system, as furnished by Westinghouse, provides for all anticipated future expansion of the pumping station.

Powering-Up electrically for future growth can offer important advantages to you. For further information, call the Westinghouse electrical engineer nearest you, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-94119

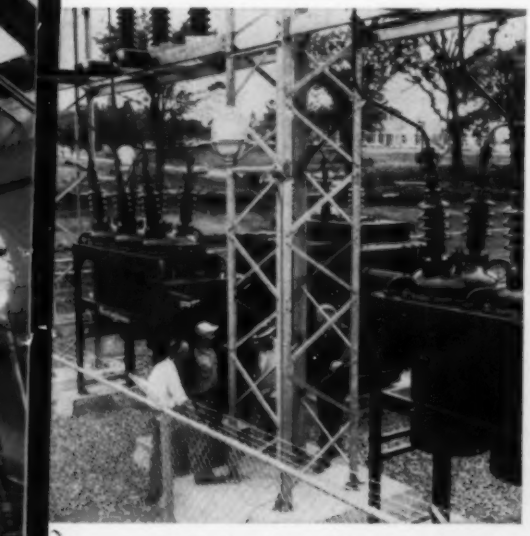
Owner: Department of Water, Oswego, N. Y.
Consulting Engineers:
Nussbaumer, Clarke and Velzy
General Contractor: McElwee-Courbis Const. Co.
Electrical Subcontractor: Snyder and Mackin, Inc.
Westinghouse Distributor: Buffalo Electric Co., Inc.

Over 250 Pages Westinghouse Data in Sweet's Construction File.

YOU CAN BE SURE...IF IT'S

Westinghouse

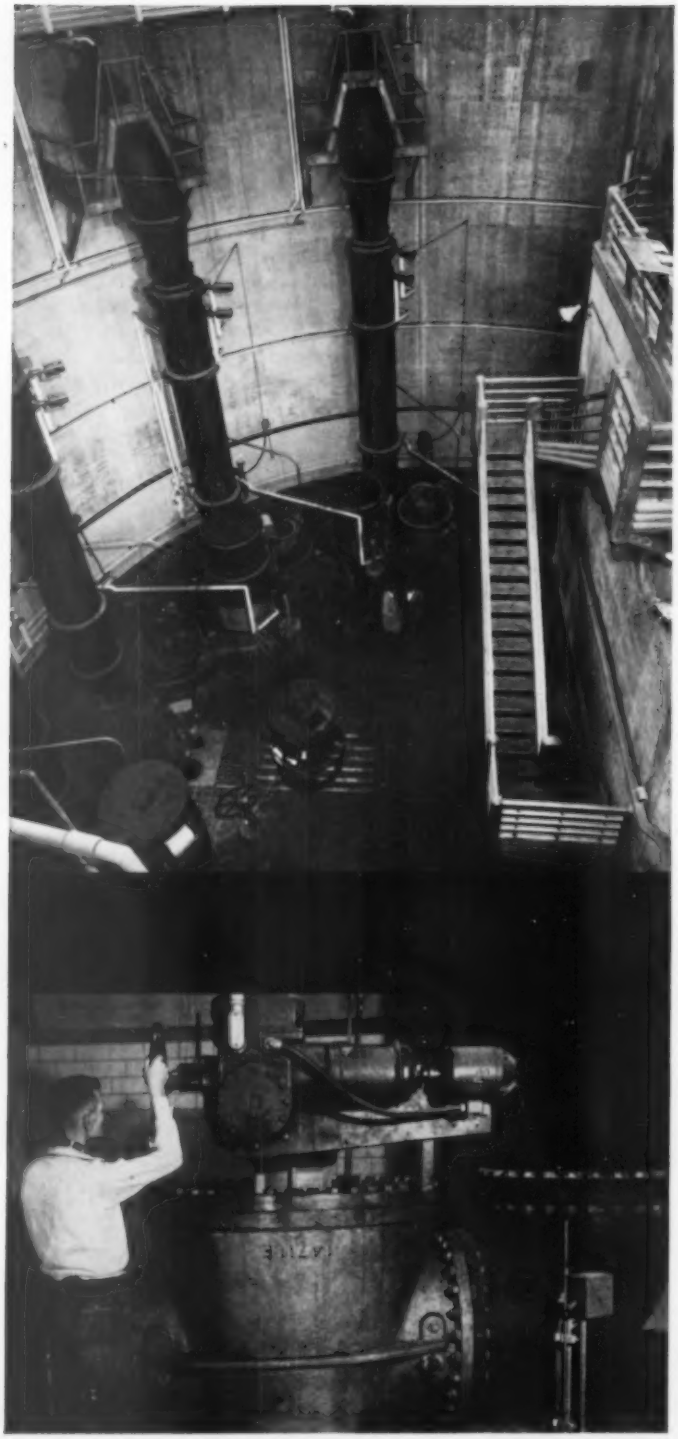
WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS"
CBS TV MONDAYS



Leo J. Landrigan, Superintendent, Oswego Pumping Station; Richard C. Mansfield, Foreman for Snyder and Mackin, Electrical Contractors; Kenneth D. Jensen; and Charles T. Hansen, Westinghouse Sales Engineer, at outdoor substation which serves new Oswego pumping facility. Two Westinghouse 2000-kva power transformers and two Westinghouse 34.5-kv oil circuit breakers are included in this substation.

Main floor view in pumping station shows four Westinghouse vertical synchronous pump motors with the glass enclosed control room in background. The mezzanine floor above is occupied by Westinghouse 2300-v, heavy-duty, metal-clad switchgear, using Type DH air circuit breakers.

Another view of main floor shows reverse side of control room and, on the mezzanine, Westinghouse double-ended control power center. Floor openings in foreground, not shown, have been provided for the installation of four additional raw water pumping units when filter plant is added.



SMS-Rotovalves On Sewage Pump Discharge

GIVE ACCURATE THROTTLING

At Philadelphia's Southeast and Central Schuylkill Pumping Stations, twelve SMS-Rotovalves with electric operators are installed at the discharge ends of vertical centrifugal pumps. These 30-inch Rotovalves were chosen for their reliability of operation and ability to throttle pump discharge accurately.

Their full-line opening cuts pressure loss to lower pumping costs. Self-purging, monel-to-monel seats are out of the stream, and less subject to wear. Rotovalves give quick, easy throttling operation. Bronze trunnions eliminate friction as the plug first lifts, then turns, finally reseats in the desired position. For emergency closure, maximum initial shut-off eliminates sufficient line surge shock to prevent damage to pump parts.

You can obtain full information on SMS-Rotovalves, as well as the complete line of Ball Valves and R-S Butterfly Valves, by contacting our nearest representative. Or, write to S. Morgan Smith Company, York, Penna.

◀*Overall view shows dry well and discharge risers. Close-up (lower photo) shows a 30-inch Rotovalve equipped with electric motor-driven operators.*

S. MORGAN SMITH

HYDRODYNAMICS

AFFILIATE: S. MORGAN SMITH, CANADA, LIMITED, TORONTO

6

Rotovalves • Ball Valves • R-S Butterfly Valves • Free-Discharge Valves • Liquid Heaters • Pumps • Hydraulic Turbines & Accessories

New Equipment

CONTINUED FROM PAGE 30A

Trade-named the "Wedge-Seal" by the manufacturer, this new valve marks a radical departure from conventional gate valves. As the wedge is lowered in the new Hamer valve to a precision metal-to-metal fit against the seats, the Teflon Seals on either side of the wedge compress against the seats to form a double sealing action. This double sealing action, states Hamer Valves, enables the new "Wedge-Seal" valve to provide a positive shutoff both upstream and downstream, eliminating the need for a double block and bleed in piping installations.

In addition to its excellent sealing action, the "Wedge-Seal" is extremely practical to service with the valve in the line. Eventual seal replacement is simple to accomplish.

The new Hamer "Wedge-Seal" is available in both 150 and 300 lb. classes. Remote control "Wedge-Seal" valves are also available.

Chemical Proportioning Pump

1124

The American Instrument Co., Inc., Silver Spring, Md., has patented and is now producing a new Microflex Chemical Proportioning pump which displaces the entire contents of the pump cylinder with each stroke of the pump, irrespective of stroke adjustment. Stroke adjustment can be accomplished while the pump is in operation.

The pump is offered in a large variety of pressures and capacities. Maximum pressure is 60,000 psi, while maximum capacity is 31.21 gals per hour.

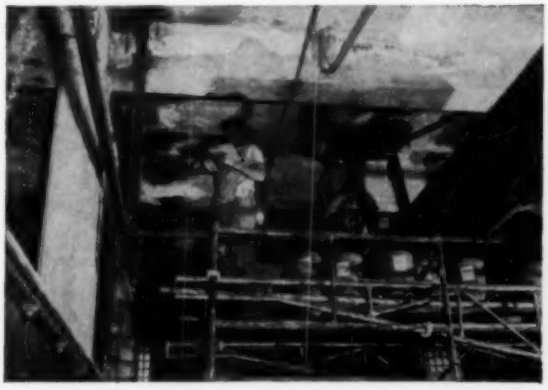
Only commercially-available packing has been used in the cylinder packing cavity. In addition commercially available bearings and bushings have been used throughout the pump.

Pressure rating and capacity of any given pump may be changed by obtaining an additional piston-cylinder assembly. Aminco so designed the pump to keep all these available assemblies interchangeable. In addition the pump is available in simplex or duplex styles and either variable or fixed piston stroke arrangements.

How THORITE and THOROSEAL made this underground structure sound again!

Workmen prepare old surface for patching with THORITE.

Water has entered the concrete and caused corrosion of reinforcing rods, blistering the concrete off surface and causing structural weakness throughout building.



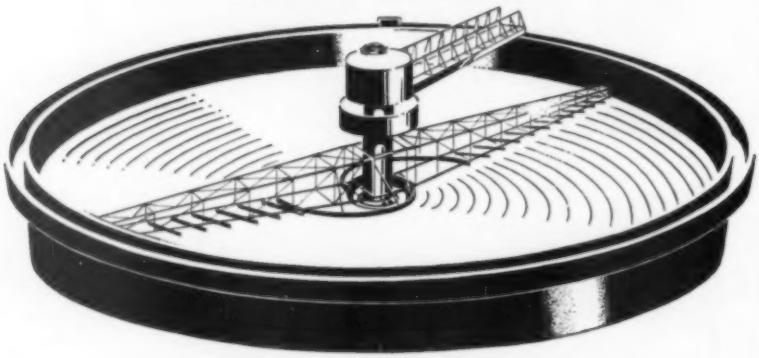
Reinforcing was cleaned, all corrosion was removed and brush coat of THORITE applied over entire patching area, then filled in with trowel coats of THORITE, even with surrounding surfaces.

THORITE Patching Mortar sets in 20 to 30 minutes and can be coated with THOROSEAL while hardening.

"How to do it" GET OUR 16 PAGE BROCHURE

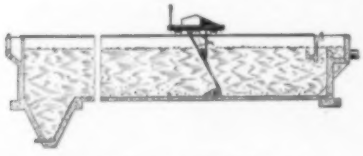
STANDARD DRY WALL PRODUCTS, INC.
NEW EAGLE, PENNA. CENTERVILLE, IND.

WATER, SEWAGE AND TRADE-WASTE TREATING EQUIPMENT



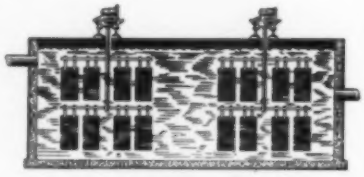
● CIRCULAR CLARIFIERS

Hardinge Circular Clarifiers are available in sizes up to 200' diameter, either center-column or beam supported for steel, concrete, wood or tile tanks. Sludge scrapers remove settled solids rapidly through central underflow discharge.



RECTANGULAR CLARIFIERS

Especially suited for limited spaces or where sludge delivery is desired at one end of the tank. A traveling scraper and skimmer carriage removes settled solids from the tank bottom and scum from the top.

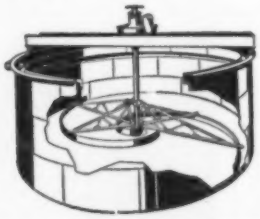


FLOCCULATING UNITS

Slowly rotating paddles on vertical shafts bring the small flocs into contact to form larger masses and hasten precipitation.

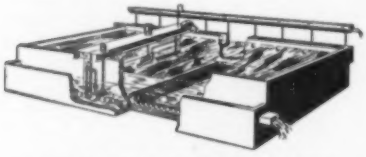
CIRCULAR CLARIFIERS

Hardinge Circular Clarifiers are available in sizes up to 200' diameter, either center-column or beam supported for steel, concrete, wood or tile tanks. Sludge scrapers remove settled solids rapidly through central underflow discharge.



"AUTO-RAISE" THICKENERS

For removal of fine suspended solids from supply water, waste water and sewage. "Auto-Raise" mechanism prevents scraper breakage. Manual or power raise supplements "Auto-Raise." Replaceable ring-type ball bearing support for rotating mechanism. Spiral rakes for maximum underflow density.

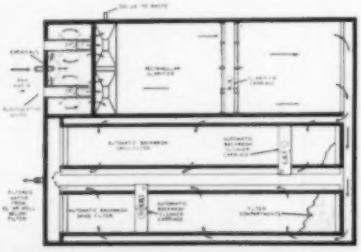


AUTOMATIC BACKWASH FILTERS

For high removal of non-settling or slow settling suspended matter. Self-cleaning sand bed. No shut-down necessary for backwashing. Traveling backwash mechanism.

COMPLETE WATER SYSTEM →

Hardinge also offers a complete water treating unit, combining flocculating equipment, clarifiers and filters in one, common-wall system, using modular construction.



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New Bulletins

AVAILABLE FREE

Metal Laboratory Equipment

1125

Metalab Equipment Co., Division of Norbute Corp., Hicksville, N. Y., has available a new 180 page Catalog that contains complete information on Metalab's expanded line of metal laboratory equipment for all industrial, hospital, educational, and research requirements. The introduction shows a variety of installations that give an idea on how to make the most effective use of Metalab equipment. A section is devoted to important construction characteristics of all component parts. This enables the user to take advantage of the flexibility and ruggedness which are inherent in Metalab equipment. The sectional units which are used as base cabinets for all the equipment are shown with all dimensions.

The catalog is divided by groups of equipment as follows: Center Tables, Wall Tables, Chemists & Microscope Desks, Titration Tables, Specialized Industrial Equipment, Dark Room & Developing Tables, Drying Equipment, Modulab Equipment, Interchangeable Units, Fume Hoods for chemical and air-conditioned requirements as well as for radioactive materials, Storage Cabinets, Sinks and Drainboard units, and accompanying fixtures and accessories.

The catalog is looseleaf bound with leatherette covering.

Gratings and Treads

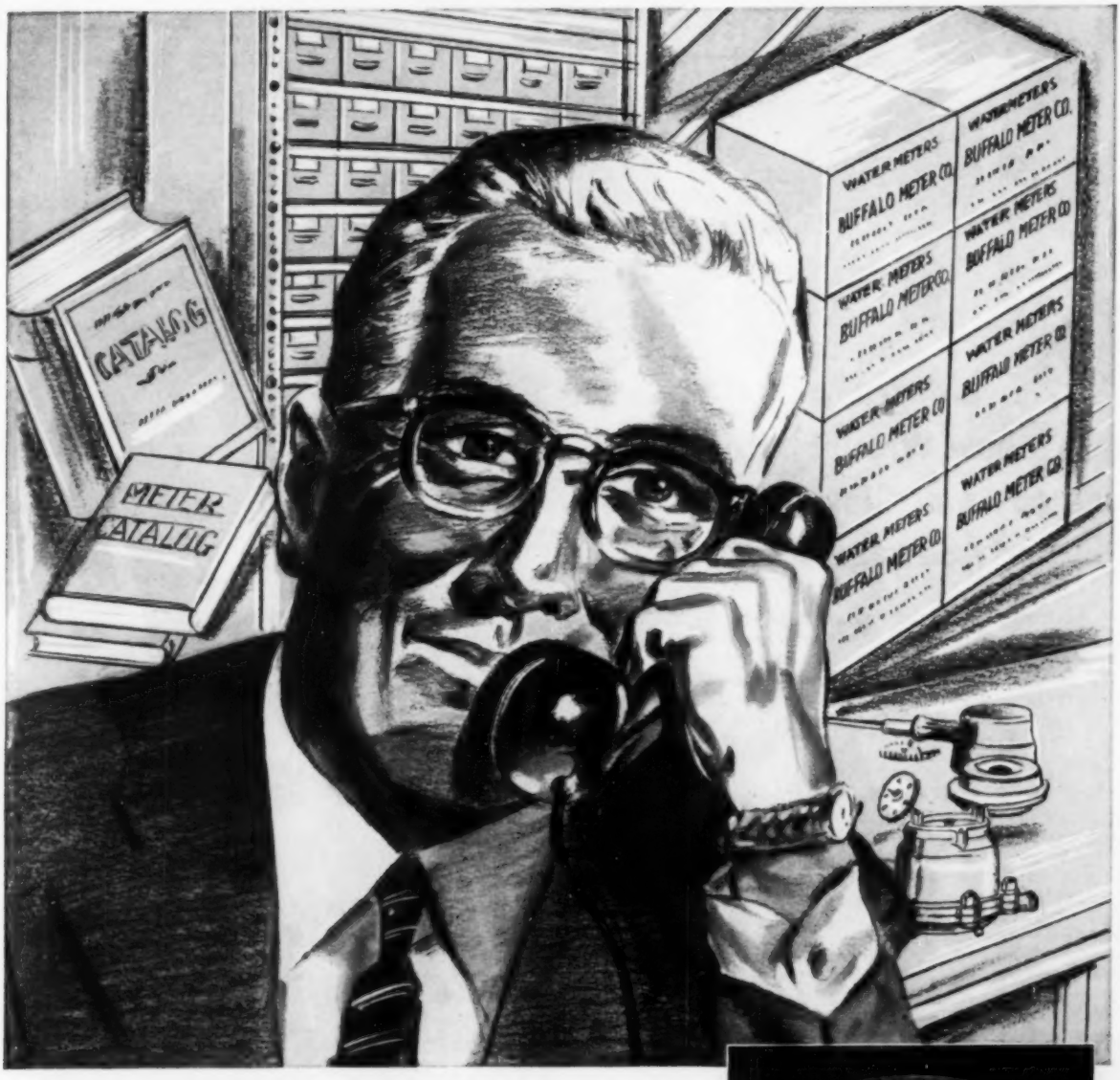
1126

Reliance Steel Products Co., McKeesport, Pa., has available a new, two-color, 16-page catalog on open floor grating and stair treads.

The catalog features many product illustrations of rectangular grating with various wearing surfaces, Relgrit abrasive embedded non-skid grating, U-type grating, radial grating and numerous styles of treads.

Complete engineering details, from panel sizes, weights and safe loads, to surface treatments and fastening methods are included.

CONTINUED ON PAGE 108A



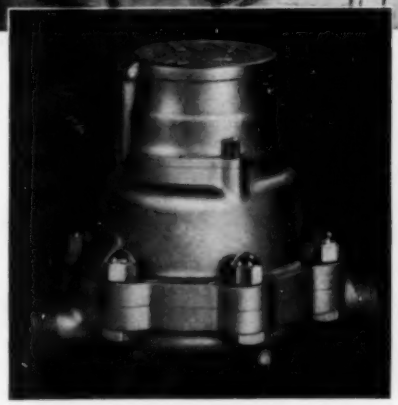
WATER DEPARTMENT PURCHASING AGENT

Expert on Values

He says, "When I purchase American Meters, I achieve two advantages, moderate first cost and reduced inventory costs!"

An experienced purchasing executive looks beyond the first cost when he purchases water meters. He must consider parts replacement and repair costs also. American Meters are noted for their simplicity of design. Fewer parts permit more rugged parts, resulting in trouble-free operation year after year. Such service reduces the need for a large parts inventory and lowers maintenance costs.

"In American Meters", says this expert on value, "I gain *both*—a moderate first cost and a reduced inventory cost—that's why I buy "American!"



American solid casing meter simplest complete meter — sizes to 6".

BUFFALO METER CO.

2909 Main Street • Buffalo 14, New York

Here's how Wrought Iron Pipe cuts costs at Cleveland's Southerly Sewage Disposal Plant

Few services are as punishing, corrosion-wise, as those found in sewage disposal installations. Sludge digestion and elutrition tank pipe for example—they can be rough.

That's why Cleveland engineers specified more than 115 tons of wrought iron pipe in the city's Southerly Sewage Disposal Plant improvement program. They wanted no troublesome and expensive shutdowns due to pipe failures in inaccessible locations.

Wrought iron pipe was installed at the Southerly site in the following services: Sludge digestion and elutrition tank piping; cold water lines—1″ to 2½″ downspouts and leaders; all heating piping; handrailings; blower lube oil piping; perforated pipe diffusers; expansion tank piping; air piping; diesel oil piping; exhaust gas piping.

In years of service life per piping dollar, wrought iron's supremacy in severely corrosive sewage disposal services has been proven time and time again. Wrought iron's corrosion resistance stems from a structural feature duplicated in no other metal—glasslike iron silicate fibers (250,000 per cross sectional square inch)—entrained in the pure base metal. These fibers act as barriers to corrosive attack.

And to further augment these unique physical properties, Byers Research just recently developed new 4-D Wrought Iron. It is 25% *more* corrosion resistant than standard wrought iron and ferrous substitutes. It is available now in tubular and hot rolled forms for your new design and maintenance considerations. Write us for new 4-D Wrought Iron literature. A. M. Byers Company, Clark Building, Pittsburgh 22, Pennsylvania.

BYERS Wrought Iron Tubular and Hot Rolled Products

ALSO ELECTRIC FURNACE AMBALLOY STEEL PRODUCTS AND PVC PIPE

Corrosion costs you more than Wrought Iron

The entire improvement program is supervised by City of Cleveland's Director of Public Utilities, Emil J. Crown, and is under the direction of Commissioner of Engineering, G. W. Hamlin, and Commissioner of Division of Sewage Disposal, W. E. Gerdel. Havens and Emerson, Consulting Engineers, Cleveland, designed the Southerly project.

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WATER METERS

Properly Designed — Finely Balanced
To Provide Highest Revenue
Year In and Year Out

HERSEY MANUFACTURING COMPANY
(Est. 1859)
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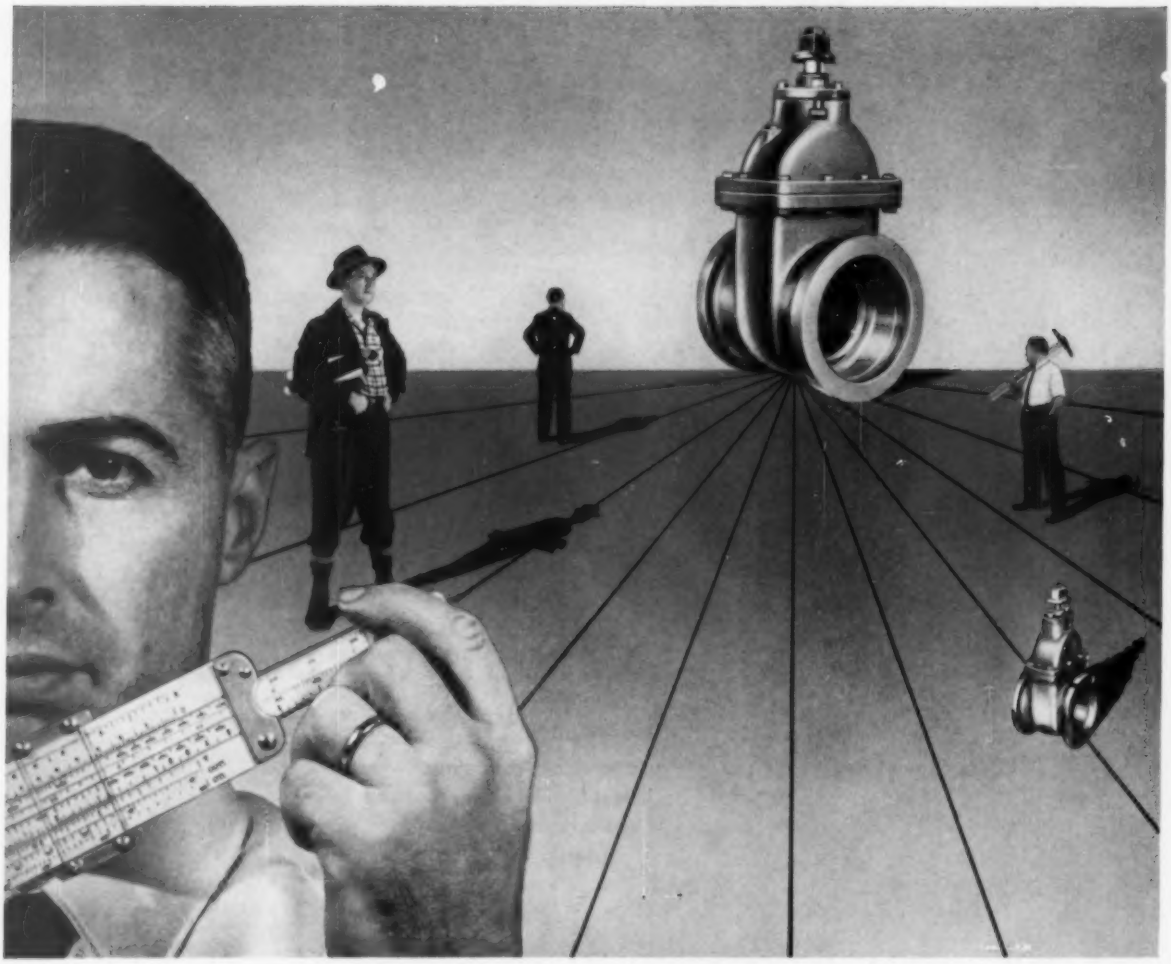

LET'S CONSIDER THE **PERFECT** GATE VALVE

Sound design and quality workmanship to guarantee ease of operation, watertight closure, years of trouble-free performance

The perfect gate valve, according to engineers and water superintendents, must combine simplicity and soundness of design, tightness of closure, ease of operation and quality of workmanship.

All Ludlow gate valves and all Rensselaer gate valves are designed to meet these requirements, as well as A.W.W.A. specifications.

Among the Ludlow and Rensselaer double disc gate valves you'll find the most complete selection of outstanding design features available today. Sizes range from 2" to 72", plus custom design engineering for special applications.

Write today for the L&R Gate Valve Catalogs

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VALVES AND HYDRANTS

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OLIVER

MODEL 80 HYDRO-TRENCHER

Rough ripping or ticklish digging

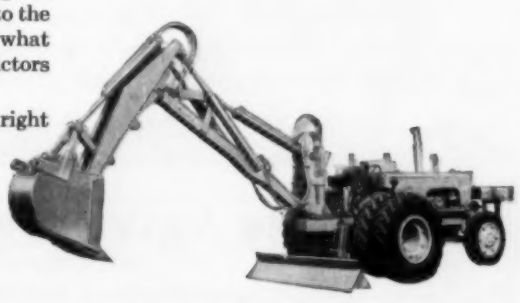
It's all the same to this versatile one-man rig, ready to handle all kinds of excavating and trenching assignments.

Powerful hydraulic pressures give you the ability to rip out pavements or to dig through the toughest soils, even frozen ground. Yet controls are so accurate and sensitive that you can "feel" your way in difficult spots to avoid damage to existing pipes, work close to foundations, etc., with maximum speed and safety.

With its amazing job-ability, the Model 80 Hydro-Trencher gives you rubber-tire mobility to travel anywhere on busy streets, get to the job in a hurry and work fast, achieving lower costs. That's what makes it a real favorite with municipalities, utilities and contractors alike.

Your dependable Oliver distributor will gladly demonstrate right on your own job. Call him today. Or write for literature.

OLIVER Model 80 Hydro-Trencher—available with gas or diesel power, six forward speeds to meet every need for travel and power. Dual hydraulic controls permit raising or lowering bucket while swinging to give you a fast digging cycle. Here's bigger production than you'll get with ordinary equipment of this type.



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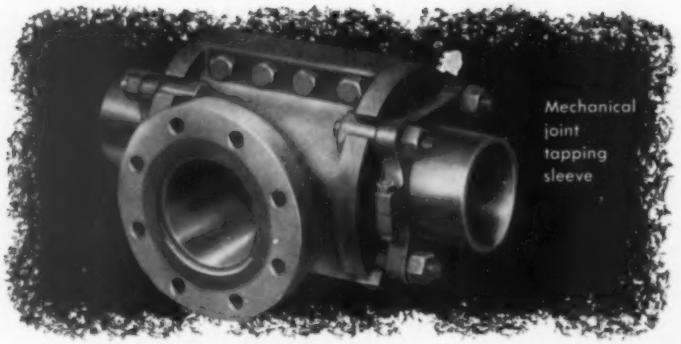
Industrial Division, 19300 Euclid Ave., Cleveland 17, Ohio

a complete line of industrial wheel and crawler tractors and matched allied equipment



for simplified, trouble-free
MODERNIZATION...
EXPANSION...
MAINTENANCE...
of your present water lines

In meeting your present and future requirements you can benefit greatly by the modern design, unique features and proved performance combined in Darling valves and allied water line products. Shown here are four of the various special-purpose Darling units that are helping effectively and economically to meet growing, changing needs in communities everywhere!

For complete information on these and other time-and-money saving water line products, send for Bulletin No. 5710.

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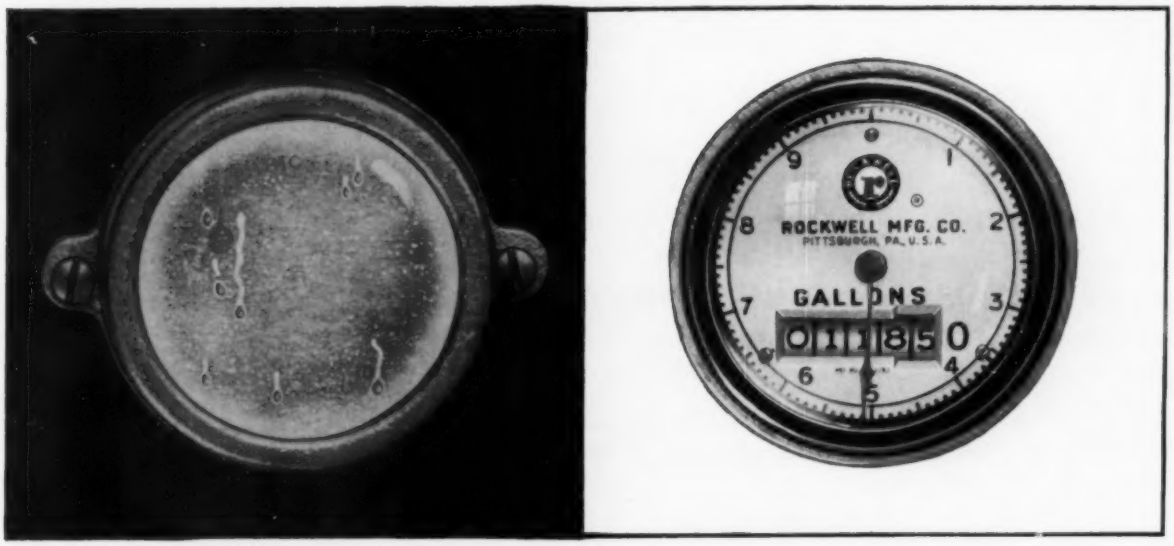
DARLING VALVE & MANUFACTURING COMPANY

Williamsport 11, Pa.

Manufactured in Canada by The Canada Valve & Hydrant Co., Ltd., Brantford, Ont.

What good is a meter if you can't read it?



DIRTY FACE

Condensation and dirt cloud the dial on this conventional register.

CLEAN FACE

Rockwell hermetically sealed register always presents a "clean face" to the meter reader.

YOU CAN ALWAYS READ A ROCKWELL SEALED REGISTER WATER METER

In recent years water utilities have spent thousands for oil enclosures, wipers and similar gadgets to lick the problem of fogged registers. Now, for not a penny extra, Rockwell offers a revolutionary new meter having a hermetically sealed register which completely eliminates condensation under the glass.

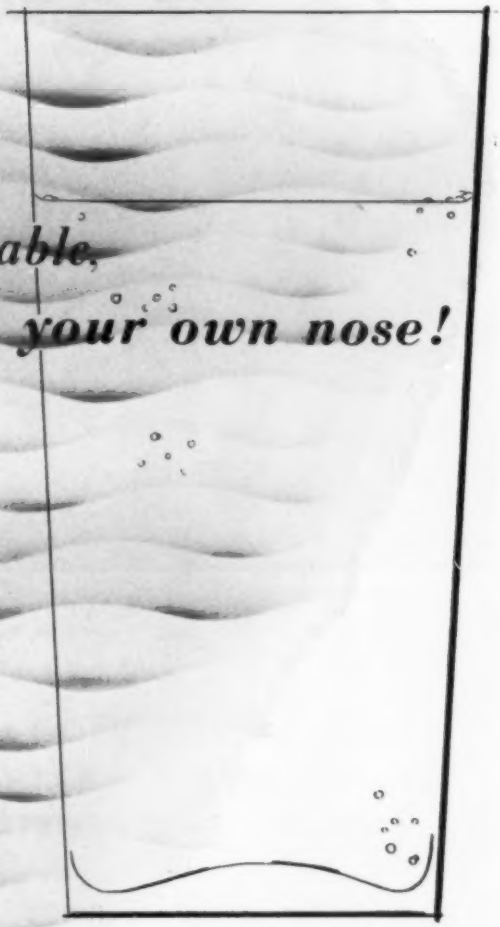
In the Rockwell Sealed Register meter all gearing, including the intermediate train, is encased in a sealed compartment high and dry above the measuring chamber. There's no stuffing box to leak or bind. A powerful magnetic coupling transmits motion smoothly and with the least possible friction. All this means less wear, less chance for corrosive attack, and, of course, easier maintenance at lower cost. Get full facts now, *write to Rockwell Manufacturing Company, Pittsburgh 8, Pa.*

SEALED REGISTER METERS

another fine product by

ROCKWELL

to be sure
your water is always palatable,
it pays to look beyond your own nose!



Objectionable tastes and odors can frequently go undetected because operators become conditioned to plant odors.

So it is sound practice to make daily threshold odor tests to detect and accurately measure variations in water tastes and odors. Consistent PALATABILITY can then be assured with AQUA NUCHAR in controlled dosage to meet changing day-to-day conditions.

AQUA NUCHAR adsorbs all tastes and odors due to algae, decaying vegetation, trade-wastes and other causes. Properly applied, it is the only method that is universally effective. And because of the low concentrations required (as little as 2 to 5 ppm average) it is economical as well.

Our field technical service staff is available without obligation to make a threshold odor survey of your plant. For information write or phone us today.

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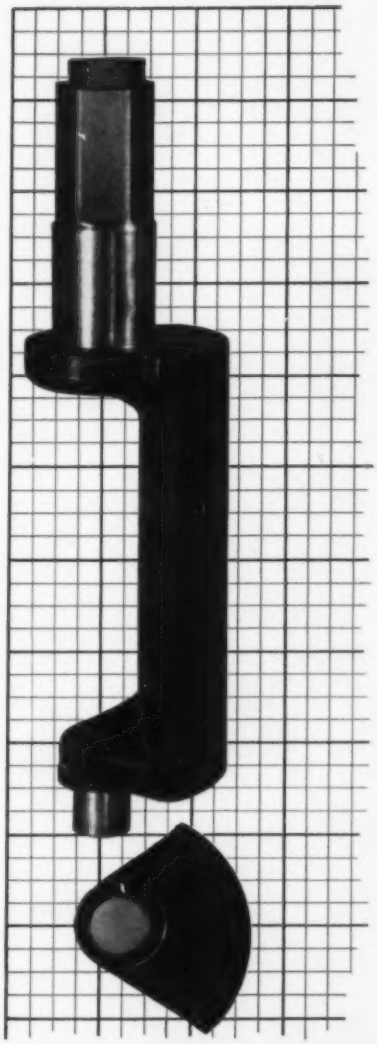


This plug makes the difference !

And the difference is DeZurik! For only DeZurik Valves utilize this resilient-faced plug—combined with Eccentric Action—to provide tight shut-off and easy operation on any line. Abrasives in the flow can't damage it—solids in the line can't prevent tight shut-off. And the single-face construction will not trap liquids where they can freeze and render the valve inoperative. You get this difference with DeZurik . . . and ONLY DeZurik!

With exclusive Eccentric Action, DeZurik Valves open easily, close tight without the need for lubricants. The plug, pivoting eccentrically, matches the eccentrically-raised seat. It touches the valve body only when the valve is closed; there's no friction, no scoring, no binding!

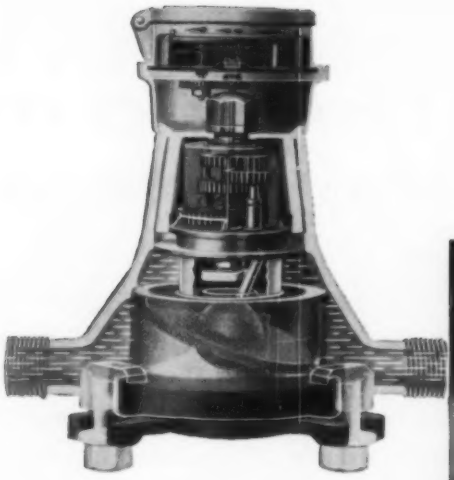
OPEN FULL

DEAD SHUT

DeZurik Valves are produced in sizes ½" thru 20", in many body materials and with a complete range of remote operators. Write for more information, or see the DeZurik representative in your area.

The wide acceptance of DeZurik Valves in water treatment plants throughout the country is further indication of their positive performance, their complete dependability, their longer life! Plant personnel and Consulting Engineers agree: The DeZurik difference is a BIG one!

DeZURIK CORPORATION
SARTELL, MINNESOTA



HOW TO DEVELOP MORE *EFFICIENCY* IN YOUR METER SHOP

When a meter man learns one Trident, he learns them all. Instead of spreading his knowledge thin over many types and models of household meters, he can concentrate on the fine points of just one, and can quickly learn to do a job of which he can be proud.

Trident interchangeability is the big reason. Parts made for the most up-to-date Tridents are designed to fit into any older Trident of the same size and type. Reordering and stock control are simplified, too. No need to keep parts for many models. Just stock a small supply of the latest Trident parts.

You need never scrap a Trident because it is a "discontinued" model. In the process of replacing work-worn parts with new, improved parts over the years, you actually modernize all the Tridents in your system.

This 50-year policy of Trident is your best assurance that the modern Tridents you buy today will earn maximum revenue for your utility . . . with lowest yearly costs . . . for many years to come. Standardize on Trident meters. It pays in many ways.

It takes money to maintain the water supply your community expects. It's vitally important to make sure all the water pumped is paid for . . . by using accurate meters . . . and by keeping these meters in good repair.

265

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TRIDENT WATER METERS

Vol. 105, No. 11 · November, 1958

WATER & SEWAGE WORKS

A Scranton Gillette Publication

Interior of syphon section in the 54-in. steel pipe main which takes water to the Lea Valley reservoirs from the terminal point of the nearly completed . . .

19-Mile Tunnel Main *beneath London*

by WILLIAM A. HEATH, Salfords, Nr. Redhill, Surrey, England.

■ A 15-MILLION DOLLAR water supply scheme is due to come into operation at London, England, early in 1960 when a 19-mile long tunnel main now being dug beneath the city is completed.

The main, which is being driven through London clay, will draw raw water from the River Thames at Hampton, on the south-western fringe of the city, and carry 70 mgd to reservoirs in the Lea Valley area in the city's north-eastern section. This supply can be boosted to 120 mgd if necessary.

Constructed in virtually a straight line, the main passes under the River Thames at two points and in several locations crosses beneath London's underground railway network.

The main is being built at such a depth that water will flow through it by gravity; internal diameter is 102 in.

The project aims at easing a serious burden on existing supplies to the heavily-populated east and central London.

Source of Supply

These areas draw about 45 per cent of water supplies from the River Lea, a 46-mile long tributary of the Thames which flows in from the north. About

37 per cent comes from the Thames in existing mains, 17 per cent from wells, and 1 per cent from gravel pits.

Reduced supplies from the River Lea have caused anxiety over a number of years. In dry weather the river's flow is seriously cut to as little as 46 mgd in drought conditions.

Curently the Lea gives 72.9 mg per square mile of catchment area in a year—and equivalent figure for the Thames is 122.6 mg. Annual yield per inch of rainfall is 2.86 mg, compared with 4.34 mg for the Thames.

In the past decade discharge of sewage effluent into the Lea has reduced the amount of water available for abstraction by about 12 mgd.

Expanded Services Increase Demand

Further pressure has been put on supplies by the building of many 4-tap and 6-tap houses in place of 1-tap dwellings destroyed during war-time air bombardment or demolished as part of Britain's reconstruction program. Additionally, two satellite towns, Harlow and Stevenage, were built nearby soon after the war ended, making further demands for water felt over a wide area.

Formerly the deficiency was made good by a standby reserve of filtration plant and pumping capacity in the Thames Valley on the other side of the city. Existing mains were used to deliver larger than usual quantities of filtered water to the central and eastern sections. This system was uneconomical because plant in the Thames Valley stayed idle when rainfall was average or excessive, while in years of low rainfall the water-storage and treatment plant in the Lea Valley was only partly loaded. Moreover, the demands of intervening districts grew, thus cutting the quantities of water eventually reaching the more distant localities.

Diameter of Tunnel Grows and Grows

In 1948 the Metropolitan Water Board, which serves a population of 6½ million in the greater London area, adopted the plan to construct a tunnel main directly from the Thames to the Lea Valley. At that time the plan envisaged a 60 in. diameter main. The following year it was decided to increase the diameter to 75 in. and in 1950 and 1951 a short experimental length was built.

The final decision to increase the diameter still further—to the ultimate 102 in.—was made in 1953. It was thought that a 60 in. or 75 in. main might have to be duplicated 25 or 30 years hence, a more expensive project in total than construction of a single 102 in. diameter main.

Work on the tunnel main began in September 1954 and construction of the last 5 miles started earlier this year. Twenty-two shafts, varying in depth from 67½ ft to 192 ft, will have been sunk along the 19-mile length of the tunnel by the time work is completed. All shafts except the terminal one in the Lea Valley are 12 ft in diameter. The terminal shaft has a diameter of 25 ft to accommodate pumps to lift the water from the tunnel main. Present plans include the installation of seven pumps, including standbys and one for de-watering the tunnel.

Precast Concrete Lines Tunnel

Conventional steel pipes and cast iron segments have been replaced as tunnel lining methods by precast concrete segments. This has resulted in a saving of about 20,000 tons of steel. Each ring consists of 12 concrete segments and is expanded into place by 12 rams operating in the tunnelling shield. Using three teams of men working round the clock progress has averaged 240 ft in a five-day working week.

Intake Features Inverted U Syphon

One of the most important final phases of the work is the building of the intake on the River Thames at Hampton. An inverted U-shaped tunnel of *in situ* concrete is proposed for this. The river-ward arm of the U will be flattened and the tunnel opening sited so that it will always be below the river level, even in worst drought conditions.

The crest of the U will be sited above the river's highest flood level in order to avoid flooding of the main. The arm of the U farther away from

BOTTOM view of one of the 22 shafts sunk along the tunnel's route.

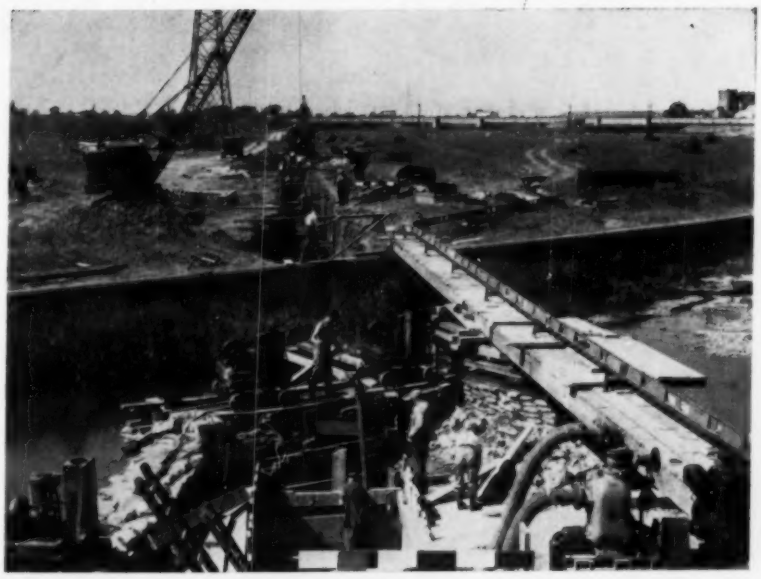
the river will curve up at an inclination above the horizontal, enabling a water seal to be maintained in the elbow of the curve.

A syphon system will be brought into operation to make water flow through the main. Water will be discharged from an overhead tank into the air space trapped in the high part of the inverted U. This will have the effect of priming the intake and starting the flow.

On the river side of the intake inclined iron bars, 1 in. apart, are being fitted to hold back flotsam and trash. It is planned to clear these bars manually, using long-handled rakes, and a low-level working platform is to be provided for this work to be carried out when the river level falls in dry weather.

After passing the intake, water reaches the tunnel main down a 140 ft deep shaft. After passing along the 19-mile tunnel it will be pumped up the terminal shaft and from ground level will go by trench main to four reservoirs in the Lea Valley area.

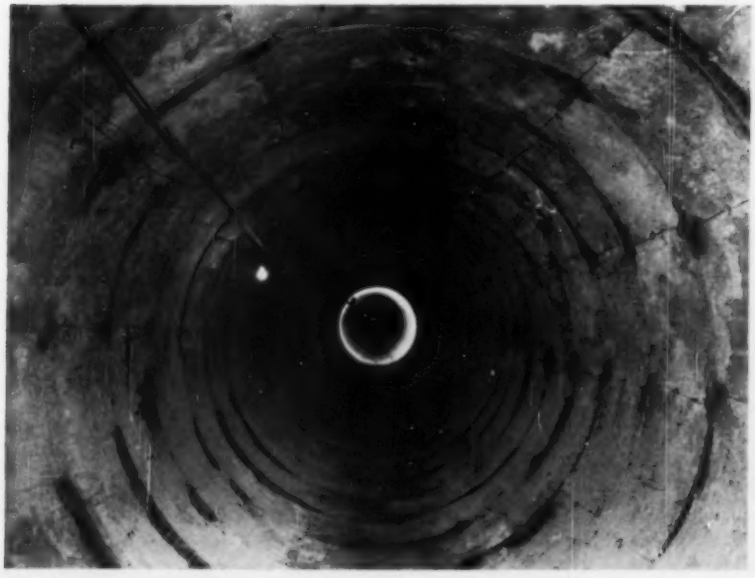
Nearly 4 miles of 54 in. i.d. steel main goes from the terminal shaft to one reservoir *via* an existing pumping station and 48 in. and 36 in. i.d. cast-iron branches feed water to other reservoirs. Another ½ mile of 54 in. i.d. steel main takes the remainder of the water from the terminal shaft to a fourth reservoir.



TRENCH main construction from terminal shaft to reservoirs.

Continuous Use Not Planned

The new tunnel main will not be in continuous use—the amount of time it will be empty depends to a great extent on the supply position in the Lea Valley. But with its completion an ever present threat of water shortage during dry spells in the crowded east and central sections of London should become a thing of the past. A large proportion of the Metropolitan Water Board's 6½ million consumers are residents in the area the main will serve and the maximum of 120 mgd it will be able to supply can go some way to meet the average consumption of 51.7 gal per head per day.



COMPLETED section of the 102-in. tunnel, showing precast concrete segments in place.

Interamerican Sanitary Congress

The tenth anniversary meeting of AIDIS, the VI Interamerican Congress of Sanitary Engineering, held recently in San Juan, Peurto Rico, featured the opening of Puerto Rico's first sewage treatment plant and a series of extremely informative technical papers.

The glossary committee of AIDIS, reported excellent progress toward the completion of a Spanish-English-Portugese-French sanitary engineering dictionary. The Allied Chemical Co., awarded medals for the best papers presented at the meeting. The medals went to a group of Dorr-Oliver, Inc., engineers for a paper on bio-filtration practice and design; to Rivas Mijares and K. A. Koller of Venezuela for their paper on design and construction of water supply aqueducts in small communities; and to Prospero Ruiz of Columbia for a paper on environmental sanitation.

In the field of water purification for municipal use, a new process is under development. It is known as . . .

Reversible Diatomite Filtration

by JUDSON G. BROWN*
Wakefield, Mass.

EDITOR'S NOTE: A new development in the use of diatomite filtration with body feed employs a thin porous membrane for the filter medium. By reversing the direction of flow of water through the filter medium, both sides of the membrane are used alternately. Test studies indicate reasonable operating costs, applicability to the solution of water plant peak load problems and excellent removals of bacteria, algae, color and turbidity. Readers' comments are invited.

■ THE PURIFICATION AND CLARIFICATION of water supplies means primarily the removal of suspended solids. The suspended solids usually found in river and lake waters consist of algae, bacteria, and silt. These solids are very fine and when filtered can form thin, slimy, impervious deposits on the septum or in the filtering medium used. In order to avoid these sealing deposits, present methods usually avoid filtration and use chemical flocculation-coagulation-sedimentation, or filtration using diatomite filter aid. The slow sand filter was the initial method employed prior to the advent of chemical treatment and the use of diatomite filter aid.

Now, in addition to these three methods, a new process called "Reversible Diatomite Filtration" is introduced as a method of purifying water. Reversible Filtration can be described as an easily cleaned variation of the slow sand filter. Its merits can best be described by comparing it with slow sand filtration.

Slow Sand Filter

The Slow Sand Filter has become outmoded due to the large area required for its installation and the difficulty in cleaning the filter bed.

Filtration

A pressure drop of 18 inches of water was considered a maximum in some European slow sand filter installations while a 4 to 6 foot head loss was considered normal in this country. When filtering algae and bacteria, the solids collected are very compressible and easily mat into a sealing layer if the pressure drop is too great.

Filtration can proceed with such a maximum pressure drop, however, as the amount of retained solids increases, the flow must be decreased to prevent a total pressure drop across the bed which exceeds the point at which the algae lattice will collapse and seal the bed. When the solids content of the raw water is low and the accumulation slow, sufficient flow can be maintained for long periods. Raw waters having concentrations of less than 40 mg/L suspended solids have been fed satisfactorily and economically to slow sand filters.

Periods up to 24 hours are required to clean the collected material from one-half acre of slow sand filters. Large volumes of water must be filtered before cleaning is required, if the process is to be economical. A prime limitation is filter cleaning.

Filter Cleaning

If a slow sand filter could be cleaned in a very short time, automatically and cheaply, the process would be economical. In addition, more turbid waters could be filtered at higher rates. For example, if the collected solids could be removed in one minute, a total filtering cycle of 10 to 30 minutes might prove very economical. A means of removing and discharging the slimy filter collections automatically, quickly and cheaply is provided by the process described in this article.

Reversible Diatomite Filtration

Reversible Diatomite Filtration provides for the efficient complete discharge of thin filter cakes from one side of a filtering septum by using raw water feed for backwashing. The significant advantage of this backwashing method is best shown in step 3 below.

Process Described[1]

In Reversible Diatomite Filtration the first phase of the process is carried out in one direction in the same manner as conventional diatomite filtration. Diatomaceous earth is fed with the raw water forming the desired filter cake thickness on the septum or cloth while filtration continues. The feature which differs from the conventional methods comes during backwash. In reversible filtration, backwashing is accomplished merely by reversing the flow through the septum in the method described below. The pressure-type filtration unit is illustrated in Fig. 1 and explained by the following typical steps:

1. With the top, or clear discharge port, of chamber **A** (labeled valve **CA**) closed, and the bottom or sludge

*Mr. Brown is a chemical engineer who heads his own company specializing in Reversible Filtration and Granger Filters.

discharge port of chamber **A** (labeled valve **SA**) also closed, feed is directed into chamber **A** through the feed port (labeled valve **FA**). This pressurizes chamber **A** with respect to chamber **B**. With valves **FB** and **SB** closed, and valve **CB** open, chamber **B** is at atmospheric pressure and filtrate is free to flow out through the top clear discharge valve **CB**.

Under this condition filtration will take place through the filter septum separating chamber **A** and **B**. Cake forms on the **A** side of the filter septum, and filtrate passes into chamber **B** and out the top valve **CB**.

2. When filtration has continued as long as desired, valve **FA**, the feed valve, is closed, and valve **SA** is opened. This releases the pressure in chamber **A**.
3. Valve **CB** is closed, feed valve **FB** is opened with **SB** still closed; this pressurizes chamber **B** by forcing feed into it.

Filtration then starts from chamber **B** to chamber **A** through the filter septum separating the chambers.

As filtrate starts through the septum it acts as a backwash, discharging the cake that had been deposited on the **A** side of the cloth during the previous half-cycle when the filtration was taking place from **A** to **B** (Step 1).

As this cake is removed from the septum all flow is out the bottom valve **SA**, carrying the cake with it.

As the filtrate flows through the septum backwashing the cake in **A**, a new cake is formed on the **B** side of the septum in direct ratio to the amount of filtrate that has passed through the septum.

Where cake is discharged on the **A** side the resistance to flow is less than where cake remains on the **A** side. This results in higher filtration rates at the points of least resistance, namely, those areas where cake has been discharged from the **A** side.

At these points of higher flow, cake builds up on the **B** side faster than at points where cake remains on the **A** side. The resistance then increases at these points of higher flow, higher pressure drop results and forces the flow to those sections where cake still remains on the **A** side; forcing off the remaining cake on side **A**. This continues until all cake has been discharged. Cake continues to flow out the bottom valve **SA** until chamber **A** is clear of all backwashed cake.

4. Valve **SA** can then be closed and **CA** opened, allowing all remaining clear filtrate to flow out the top.
5. When filtration has been carried out as long as desired, the feed to chamber **B** is shut off by closing valve **FB** and the pressure in **B** is released by opening valve **SB**.
6. Valve **CA** is then closed and **FA** opened. (The cycle has now reached the reverse of step 3 shown above and continues through step 6 with all references to **A** interchanged with **B**.)

Cake Discharge

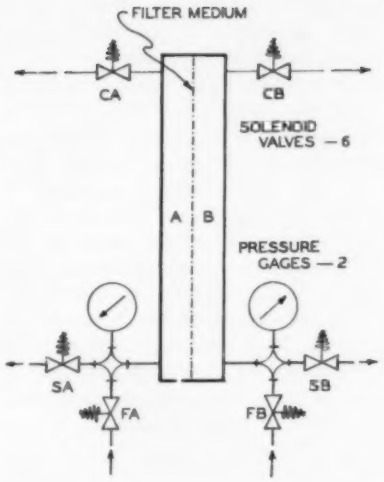
The automatic cake discharging process described above is particularly well suited for the type of solids in water supplies — the type of solids that usually are very difficult to remove and discharged from the filtering unit.

One way of removing this deposit is to dispose of the filtering medium with the deposit. This is the procedure used in the disposable cartridge type of filter, the replaceable paper pad and felt filters, the precoat filters, and the slow sand filters. Sand filters that are washed in place are a variation of this.

Another approach which aids discharging these slimy solids is to prevent their penetration into the medium. This keeps a separate cake on the surface that can be separated from the medium or septum easier. This is known as *cake filtration*. When the retained solids are mixed in with the filtering medium as in a disposable cartridge filter, the process is known as *filter media filtration*.[2]

In cake filtration the deposited cake can be peeled from the retaining filtering septum during backwash, when the pressure drop across the cake is sufficient to break the mechanical bond between the cake and the retaining septum. When a clear non-plugging fluid is used to backwash a thin slimy cake, as is the persent practice in cake forming filters, a portion of the cake will be discharged with the initial surge. Then, with a portion of the cloth cleaned, it is no longer easy to build up a pressure drop across the cake and septum to force any more cake off. This is the effective end of the backwash and over half of the cake may remain on the cloth.

The backwashing pressure drop required in order to obtain satisfactory discharging is the problem. This problem has been helped in the past in cake forming filters by the following methods:



1. Backwash only a small portion of the total filter septum at one time — this system allows the full volume of the backwash pump to work on a small area and provides a higher pressure drop over that small area. By the use of individual plate valves, one plate in a filter press can be backwashed, then sealed, and a second leaf backwashed. This operation is continued plate by plate until the filter is cleaned. This procedure is also used in a tube filter.
2. Use air pressure surge domes to increase the velocity of the initial backwash — this method holds the pressure drop, over the cloth, higher for a short period of time and improves the backwashing efficiency.
3. Use monofilament wire and synthetic fiber cloths — these greatly decrease the mechanical attachment of the cake to the septum. Therefore, the pressure drop over the septum and cake on backwashing need not be as great.

Coating Septum During Backwash

Reversible Filtration plugs the septum on the opposite side of the cloth in those areas where cake has been removed by the initial backwash surge. This new coating on the second side increases the pressure drop through the filter septum and water traveling the path of least resistance tends to force off the remaining cake. This old cake discharging and new coat plugging, continues until the cake is

completely discharged. This is similar to the step-wise plate discharging described in (1) above.

Reversible Filtration discharges a cake completely from one side of the septum and places a new cake on the opposite side in one operation. The first side of the septum is purged by filtrate all during the cake discharging period. Therefore, when the last of the cake has been discharged, the clear filtrate can be collected and filtration continued in the same direction until the new cake must be discharged by reversing the cycle.

Backwashing is automatic and quick and can be done frequently. If it is done frequently, filter cakes are kept thin and thin filter cakes mean less resistance to flow and higher filtration rates. These higher filtration rates make it economically possible to reduce the pressure drop and reduce the amount of filter aid required. If a Reversible Filter cake is 1/20 as thick as a standard cake, then 1/10 the pressure drop can be used while maintaining twice the filtering rate. In the case of diatomite filtration of water supplies, the lower filter aid requirement is very important since it is the most expensive item. Lower pressure drops are desirable for four reasons: (1) in filtering the highly compressible algae, less filter aid is required with lower head losses; (2) lower pressure drops usually give better quality filtrates; (3) power is saved; and (4) there are equipment savings.

Municipal Water Filtration Tests

In most Reversible Filtration tests to date on water supplies the above described cake discharging feature has made it possible to eliminate the use of diatomaceous earth precoat. The cake discharging feature has also allowed the economical use of less body aid but the use of some diatomite as body aid greatly increases the filtering rates and improves the cake discharging.

In raw waters having high dissolved color, alum treatment is used to remove the color. In the past, waters high in color, were usually treated most economically by flocculating and settling prior to filtration on sand filters or diatomite filters. This type of treatment has been required because of the difficulty in filtering the alum precipitate formed.

With the cake discharging feature of Reversible Filtration it has been possible to filter, economically, alum precipitated color from water without prior flocculation and settling, an operation more economical than existing or proposed rapid sand filter plants operated well below capacity.

Quality

In the experimental studies, the quality of unchlorinated Reversible Filtration effluent has been equal to chlorinated filtrate from rapid sand filter plants. In cases where the dissolved iron and manganese content is high, oxidation prior to filtration is required in both systems. Dissolved odor and taste can be reduced in both cases by treatment with activated carbon.

The high quality of diatomite filtered water is well known.[3,4] Reversible Filtration uses the low head loss of the slow sand filter plus the body aid of the diatomaceous earth filters. Thus, if the chlorination should fail, it still provides a high quality filtrate that should be furnished municipal water systems. Too many present rapid sand filter plants rely heavily on chlorine treatment, and a chlorination failure would probably produce unsatisfactory water.

It is not proposed to eliminate post chlorination at any time, but it is desirable to point out that Reversible Filtration with diatomaceous earth appears to provide a second line of defense in case of chlorination failure. This defense is not available with ordinary rapid sand filter plants. It has also been shown that diatomite filtration removes some harmful organisms that are uncontrolled by chlorination and not removed by rapid sand filter plants.[4]

Costs

Reversible Filtration has been described as a slow sand filter that uses diatomite body aid (similar to standard diatomite filters) with an automatic cake discharging procedure. An approximate comparison between standard diatomite filtration and Reversible Filtration can be shown by the use of recent data. A small portable Reversible Filter was operated in a municipal water plant which uses porous stone tube diatomite pressure filters. Both units used the same swampy lake water. The comparison is shown in the accompanying table.

The relative costs of the bare filters as presented in the table will be reasonably constant for installations of this size and larger. In 150 sq ft installations the ratio will be nearer $20 to $10/sq ft of filtering surface. Present figures indicate an installed cost for reversible filters equals about half the installed cost of pressure tube filters per unit of capacity. These more useful complete installation costs for the two systems will vary with preferences of different customers and designers.

Additional Test Data

Three other tests are described to show some of the filtration problems for which Reversible Filtration is being proposed.

City Water—Boston, Mass.

Water furnished to Boston is chlorinated but not filtered. As it is taken from the mains, it contains dead algae and the normal suspended solids in a large clear reservoir, plus the iron picked up in the mains.

One gallon of this water plugged a one square inch disk of Whatman 41 filter paper at 120°F under a constant vacuum of 11 in. of Hg after 22 minutes. A dark tan deposit was left on the paper.

In a test run this water was filtered with 140 lb of Dicalite Speed-

Comparison of Standard Diatomite Filtration with Reversible Filtration

	Porous Stone	Reversible Filter
Gal/sq ft/min	0.8	2.0
Ft of Water Head Loss	30 (avg)	4
Precoat—lb/mil gal	150	0
Body aid—lb/mil gal	400	400
Body aid—$/mil gal	$18	$18
Filter Cost Investment $ sq ft	20	5
Sq ft filter surface/3mgd	2600	1040
Filter Investment—$/3mgd	52,000	5200
Filter Dry Weight—lb/3mgd	54,000	1000
Size—cu ft/3mgd	1,200	100
Sq ft floor space/3mgd	420	54

plus diatomite per mil gal of filtrate — cost $5.60 at a delivered price of $80 per ton in Boston in car load lots of 30 tons. The portable test Reversible Filter contained six square inches of Nitex 36 nylon bolting cloth with an opening of 36 microns. An average rate of 5 gpm per square foot was obtained with a pressure drop of between 6 inches and 24 inches of water through the filter. A gallon of the filtrate produced would pass through Whatman 41 filter paper in 2 min.

The test cycle consisted of one minute to purge the cake and residual feed, and 10 minutes of clear filtrate collection. It was estimated that a 1.5 mgd filter installation for this application would cost about $2,000 for the bare filter and about $6,500 to install with piping, valves, timer, tanks, and filter aid feeder.

Later work showed that a Nitex 75 cloth with a 47 per cent open area and 75 micron openings would be better for this work. The above estimate includes this cloth in the filter cost estimate. This is a 200 sq ft filter containing 24 plates with 8.6 sq ft per plate. Each plate would be 36¼ x 41¼ x ¾ in. The port system is designed for 10 gpm/sq ft and has 0.7 sq in. of port area per 100 sq in. of filtering surface.

Merrimack River—Lowell, Mass.

A test was made on November 13, 1957 when the river water had a turbidity of 6 mg/L, a color of 48 mg/L, and iron of 0.70 mg/L. The effluent after alum and Speedplus treatment had a turbidity of 1, a color of 8, and an iron of 0.08 mg/L. The amount of Dicalite 4200 filter aid required varied from $150 and $216 per mil gal. The bacteria content was reduced, without any chlorine, from 2400 MPN to less than 3.6 MPN. All five lactose tubes (10 ml) on the raw water were positive and all five lactose tubes (10 ml) on the filtered water were negative.

A one minute purge and 10 minutes clear filtrate cycle was used. The pressure drop was from 2 to 4 ft of water. A 325 x 325 mesh, .0014 inch wire stainless steel cloth was used. A filtering rate of 1.5 gpm per sq ft was obtained.

Algae Removal

In a test on water containing 2,000,000 chlorella per ml, which are 2-5 micron spheres, the algae were concentrated by a factor of 7 at a total feed rate of 2 gpm/sq ft. Head loss was 2 ft of water using the Nitex 75 nylon bolting cloth. A mixture of equal weights of Dicalite Speedflow and Speedplus were used. Cost of the filter aid was $150/mil gal.

The objective here was to recover the Chlorella without hurting them or reducing their activity. The remaining 6 volumes of relatively algae free water were to be discarded. The filter aid was easily separated by settling from the chlorella and could be reused with probably less than a 10 per cent loss per cycle or a net cost of perhaps $15.00 per million gallons processed.[5] A 3 minute cycle was used.

Peak Load Applications[6]

In most water systems there is a considerable variation between the peak water demand during hot summer days and minimum needs during cold winter days. In the past it has been the practice to build a rapid sand filter plant large enough to handle the predicted peak demand for a ten or twenty year period. The full capacity of the plant would not be expected to be used except perhaps for one day ten or twenty years after it is built. Such a design means that the indirect charges based on the total investment must be carried by a relatively small amount of water treated. The indirect charges are the interest on the bonds issued to raise the money to build the plant, the amortization of the plant over its expected life, and maintenance charges. These three items can be figured several ways but the usual result is a cost of between 6 and 8 per cent per year of the total investment.

A recent rapid sand filter plant built for $800,000 has a rated capacity of 3.5 mgd with some extra provisions for future expansion to 5.25 mgd. During its first year of operation 229 million gallons were produced, or a utilization of less than 20 per cent of the available capacity. The indirect charges amounted to about $210.00 per mil gal produced while the direct costs for chemical, power, and labor were about $137.00 per mil gal. Total cost of the water produced in 1956 was about $347.00 mil gal.

In another municipal water department desirous of expanding its capacity from 8 to 14 mgd, a rapid sand filter plant has been proposed for the additional 6 mgd at an investment of $2,000,000. This unit would operate only during the peak demand days of the summer. It is estimated that the total production for the first three years will be 440 mil gal or about 5 per cent of capacity. These 440 million gallons will cost about $1,000 per mil gal due primarily to the indirect charges of over $800/mil gal.

This type of excessive peak demand charge exists in all variable demand cases. These indirect costs may not be known or figured, but one way or another they exist and either the water consumer or the taxpayer will pay these indirect charges as well as the direct charges.

A rapid sand filter plant is an economical way to produce city water supplies when it is operated at full capacity. However, when it is idle, the indirect charges do not stop, and the small production must carry all charges. A promising solution to this problem is to be found in the use of the low investment diatomite filters. It has been estimated that the peak demand water required in the second example above could be produced for about one-third the above costs if a Reversible Diatomite Filtration plant were used without flocculation and setting of the feed before filtration.

The relative economics between the two systems will vary as the water supply changes. In waters where alum treatment is not required for color removal the diatomite filters do much better. The entire water demand is being handled in some cases more economically with diatomaceous earth filters than would be possible with rapid sand filter plants. In the second case above where 6 mgd of peak demand is needed, a very dirty raw water is to be used and alum treatment is required. In this case the rapid sand filter plant would be cheaper than the Reversible Filter if it were used, as an average, at more than about 15 per cent of capacity.

A third system may be considered where dissolved color is involved. This system includes flocculating and settling prior to diatomite filtration as used in the portable potable emergency water supply systems, it has the disadvantage of the large flocculating and settling equipment but will require much less filter aid.[6]

Present data indicate that in many cases a rapid sand filter plant should

be sized so that it is just big enough to handle the average demand and can, therefore, operate all year at near its full capacity. The peak demands, however, could be handled in these cases by low investment diatomite filters. The team of the two systems should provide the cheapest water.

The proposed team of two systems should be particularly helpful in the expansion plans of existing water works departments. The small size of the Reversible Filter should make it possible in many areas to install the needed additional capacity in existing buildings. This low investment proposal will apply particularly well to summer resorts and fire fighting where exceptional peak demands are encountered for short periods.

Comment and Criticism

Before submitting this article for publication, the author submitted it to three reviewers: Robert H. Culver of Camp, Dresser & McKee, Cons. Engrs., Boston; R. Zadigan, of Great Lakes Carbon Co., Buffalo, N. Y.; and G. R. Bell of Johns-Manville Research Center, Manville, N. J. Many of their suggestions were incorporated into the manuscript; a few seem to be controversial. Excerpts from the reviewers' comments follow:

ROBERT H. CULVER—" . . ., the introduction of raw water on both sides of the filter is a doubtful public health practice. It is well known that bacteria adhere to the walls of pipes and tanks and grow and multiply thereon. If they come in contact with both sides of the filter septum, contamination of the filtrate cannot be prevented."

"In regard to removal of color by alum treatment it is generally considered necessary to provide flocculation to promote the adsorption of the color by the coagulant particles as well as to develop particles large enough to be removed by settling. You have given no evidence that this procedure is not equally necessary when using Reversible Filtration."

R. ZADIGAN—"I question the advisability of diatomite filtration of alum treated water without settling."

G. R. BELL—"The heart of the process is, of course, the ability of the filter to backwash cleanly, completely and quickly. If it does not backwash cleanly, there is a progressive loss of filtering surface leading to eventual outage of the filter. If it does not backwash completely the chance of filtered liquor contamination is serious. If it does not backwash quickly, the ratio of wash losses to production is prohibitive from an economic standpoint."

"This process appears to provide adequate means for accomplishing each of these important phases of the operation."

"The process, while lacking large scale field tests, would appear to have immediate applicability to industrial and other water supplies needing the quality of diatomite filtration."

"Its application to potable water supplies appears to face a long period of evaluation because of the potential contamination of the filtered water with the cake from the previous half-cycle. Health officers properly take the safety of the consumer as the ultimate criterion for any water purification process."

"It is to be hoped that an actual installation of sufficient size to give real cost figures can soon be made. The writer is well aware of the pitfalls of scaleup from pilot plant to operating equipment. Plant-scale equipment is expensive, both for the basic filter and accessories, and for their installation. Thus, for example, a 6-in. gate valve costs about twice as much as a 4-in. one does. Make them automatic and the ratio may be 4 to 1. Other accessories are similarly scaled up so that the savings which may result from larger filters are quickly eaten up by other costs."

"Similarly, the actual costs of operation must be obtained from large enough equipment over a sufficient period of time to evaluate such factors as applicable ranges of turbidity, amount and type of filter aid required, and probable maintenance costs. In addition to costs, such an operation with proper records will do much to establish the reliability of any new type of filter."

Author's Closure

With respect to contamination of both sides of the filter, while it is true that in the reversal process the feed chamber is purged and then used as the filtrate collecting chamber, the point to remember is that the amount of this contamination must be considered in relationship to the amount allowed to pass through the filter. If a suspended solids removal equivalent to the separation obtained in a rapid sand filter plant is desired, then all data to date indicate that "filtrate chamber contamination" will not be a factor.

Reversible Filtration, because of the low head loss used and the finer grades of filter aid that can be used economically, has produced even better filtrates in tests than present diatomite filters as currently operated. It is only when producing such filtrates that "filtrate chamber contamination" might become a factor. There is not sufficient data accumulated to date to indicate at what point this will become a factor.

With respect to removal of color by alum treatment, there is the belief that unprecipitated organic acid color is adsorbed on the alum floc, and that alum floc must grow first to adsorb the color.

I believe that the problem here can be resolved by first defining carefully the terms that are used. The question is what are suspended color, precipitated color, dissolved color, and unadsorbed color. The point is that there is no sharp line that can be drawn between a suspended color and a dissolved color.

If one wishes to split the color producing material into two groups according to particle size and label one group suspended and the other dissolved, then the splitting method must be defined. One procedure is to define the mechanism used to separate the two fractions. Perhaps such a standard exists but has been largely forgotten. A suitable procedure is to use a Whatman 41 filter paper with 11 in. Hg vacuum at 60°F. Any value obtained in this manner, however, has little bearing on the amount of color removed by a slow sand filter, a pressure diatomite filter using Dicalite 4200 (coarse grade) at 50 psi pressure drop, or a Reversible Filter using Speedplus (medium grade) at 2 psi pressure drop.

One test on the Concord River water at Billerica, Mass. showed a total color of 36 mg/L. A laboratory filter paper test showed a dissolved color of 20 mg/L. A Reversible Filter filtrate using Speedplus at 2 psi pressure drop showed a color after filtration of 10 mg/L, indicating a removal of dissolved color.

The question of color adsorption on an alum floc can perhaps be bet-

ter understood if it is approached from the view that all color consists of particles of various sizes. The finest particles are said to be in solution. When alum is added, the particles immediately begin to coalesce and grow into larger particles or flocs. This growth process is a continuous process and can be continued until the floc is large enough to settle out of water. Some of the smaller floc can be stopped in a coarse sand filter. Some of the still smaller coalesced particles, which might not be called floc, can in turn be stopped by coalescing with floc already in the sand filter or actually filtered out by the floc in the sand filter.

The amount of retention time required after alum addition is a function of the size of the particles required for the separation process used. In Reversible Filtration a very fine particle can be retained and therefore very little retention time is needed. In the tests to date, the minimum retention used has been about 5 minutes after good agitation. Total colors of 40 to 70 mg/L containing 25 to 35 mg/L of so-called dissolved color have been reduced with alum to readings of 1 to 2 mg/L in more than 30 different tests at different seasons on 5 different supplies. Lower retention times will be evaluated on larger equipment. With respect to the advisability of diatomite filtration of alum treated water without settling, it is true that in precoat filters it is uneconomical to filter alum treated water without pre-settling. This fact is true because the cycles become so short that the labor and precoat costs become too great. Both of these costs have been eliminated in Reversible Filtration. The body aid requirement is also greatly increased by filtering all the alum floc in both systems.

Pre-settling of the alum floc can be used with Reversible Filtration just as it is in some present diatomite pressure tube and leaf systems. The objective to date has been to show that Reversible Filtration reduces the cost of filtering without pre-settling to the point where the elimination of the expensive flocculating and settling equipment must be considered.

Every installation must be evaluated separately. In emergency applications or extreme peak load situations where capacity will be idle more than 95 per cent of the time, it appears now that alum precipitated color should be filtered without flocculation and settling equipment. This situation is economically described in one of the examples in the paper.

The author appreciates the comments of the reviewers. Since Reversible Filtration is in the early stages of development, additional tests, evaluation and discussion will be required. Comments of readers will be helpful.

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Saline Water Treatment

In our February 1958 issue, on page 70, there appeared an article by Ralph H. Sievers, Jr., entitled "Saline Water Treatment." With respect to that article, the Maxim Silencer Co. has pointed out that the article does not distinguish clearly between brackish water and sea water, and that some readers might possibly be misled by certain of the figures shown, for this reason.

"For example, the conversion cost for electrodialysis is shown as 65c per thousand gallons. However, it should be pointed out that this low cost is only possible with brackish, i.e. slightly saline water, on the order of 5,000 ppm or less. According to published figures on certain electrodialysis plants, electric power consumption varies from 5 kwh to 7 kwh per thousand gallons, *per 1,000 ppm of salinity reduction.*

"For sea water with a salinity of 35,000 ppm, requirements may be estimated at 180-245 kwh per 1,000 gallons. At a cost of 2c per kwh, electric power cost alone would be from $3.30 to $4.90 per thousand gallons of water. Even at a rate of 0.7c per kwh, used by the Office of Saline Water, power cost would be $1.26-$1.72. This does not include other operating costs, such as labor and maintenance, and amortization.

Because of this high power cost, electrodialysis is not considered practical for *sea water.* Its use is usually confined to brackish water. We believe you will find this is recognized by manufacturers of this type of equipment.

"The Maxim Silencer Co. has submitted figures to the Office of Saline Water, showing that a Maxim distilling plant, combined with a steam-electric power plant, can produce fresh water *from sea water or other saline water* at a cost of 63c per thousand gallons, assuming fuel at 25c per million Btus and electric power at 7 mills per kwh, which are the rates used by the O.S.W. for comparative purposes. This cost includes fuel, power, labor, maintenance, amortization, and interest. As this figure illustrates, the cost of sea water distillation by the new Maxim process is much less than the costs indicated in Mr. Sievert's article, with the exception of electrodialysis, which as we have just pointed out, is not applicable to sea water.

Commercial Standard For Vitrified Clay Sewer Pipe

The Commodity Standards Division, Office of Technical Services, U. S. Department of Commerce, has released a recommended Commercial Standard for Vitrified Clay Sewer Pipe for industry consideration and acceptance.

It provides definitions and requirements for standard strength and extra strength glazed or unglazed vitrified clay sewer pipe in the types and sizes normally produced in the industry. The standard is meant to serve as a primary reference to existing nationally recognized specifications.

Limited copies of the recommended standard, designated TS-5414, are available on request from the Commodity Standards Division, U. S. Department of Commerce, Washington 25, D. C.

"You never stub your toe standing still. The faster you go, the more chance there is of stubbing your toe, but the more chance you have of getting somewhere."
—Charles F. Kettering.

Calculation of Results is an important part of . . .

Field Testing of Centrifugal Pumps

Part II

by FRED W. BELTZ, JR.
DeLaval Steam Turbine Co.
Trenton, N. J.

EDITOR'S NOTE: In this second of two parts, the author discusses the calculation, plotting and interpretation of results. Part I of this practical plant operating article, appeared in the July, 1958 issue, page 275, and detailed the steps required in planning and conducting field tests.

Calculation of Results

After the measurements have been made and recorded as in Table 2, the results calculated as shown in Table 3, the operator can then plot a series of curves representative of the pump's performance.

The flow, Q, will be the actual flow, measured in gallons per minute.

The total dynamic head will be the sum of the difference between the discharge head and the suction head plus the velocity head:

$$H = h_d - h_s + h_v \quad (12)$$

in which h_v represents the change in static head or measured head due to the difference in velocity between the suction and discharge pipes. If they are the same size, $h_v = 0$. However, the suction pipe normally is larger in diameter than the discharge pipe. The velocity head is calculated from

$$h_v = \frac{Q^2}{K} \quad (13)$$

using the appropriate K value from Table 4. It should be noted that if pressures are measured at a point in the line, different in diameter from the suction or discharge, the velocity head must be based on the diameter at the point of measurement.

The water horsepower will be:

$$whp = \frac{Q\,H}{3{,}960} \quad (14a)$$

which is exact for water at 68F and is reasonably accurate through the range from 32F to 100F. Above 100F, the equation must take into account the specific gravity of the liquid being pumped:

$$whp = \frac{Q\,H\,W}{3{,}960 \times 62.32} = \frac{Q\,H\,S}{3{,}960} \quad (14b)$$

The speed does not actually enter into the calculations unless the operator wants to analyze the results in terms of using a driver with a slightly different speed or wants to correct the speeds to the manufacturer's original test speed. To correct for a change of speed, it is first necessary to calculate the test point as run. Next, the flow, the head, and the brake horsepower are corrected by:

$$\frac{n_1}{n_2} = \frac{Q_1}{Q_2} = \left(\frac{H_1}{H_2}\right)^{1/2} = \left(\frac{bhp_1}{bhp_2}\right)^{1/3} \quad (15a)$$

Eq. 15a can be broken down into the three separate corrections, as follows:

THE AUTHOR (right) is logging and checking pump bearing conditions at the Trenton (N. J.) Water Works Pumping Plant.

Table 2

Pump Test Record

By: FWB Date Test No. 42-1-1
Pump: High Head Pump No. 42
Rating: 6950 gpm 220 ft head 1180 rpm 439 bhp
Type: Single stage, 16" side suct. 14" side disch.

		Test Point No.	1	2	3	4	5	6
1	Venturi man. deflection	in. hg.	9.5	7.05	3.65	1.70	0.51	0
2	Venturi constant		2,707	→	→	→	→	→
3	Flow	gpm	8,350	7,050	5,180	3,520	1,930	0
4								
5	Suction man. deflection	in. hg.	—7.9	—7.1	—6.3	—5.6	—5.2	—4.8
6	Suction	ft.	—9.0	—8.0	—7.2	—6.4	—5.9	—5.4
7	Elev. corr.	ft.	+0.3	→	→	→	→	→
8	Corr. suct. head	ft.	—8.7	—7.7	—6.9	—6.1	—5.6	—5.1
9								
10	Disch. gage reading	psig	72.6	91.9	102.9	108.6	112.3	116.1
11	Disch. gage corr.	psig	—2.2	—2.4	—0.8	0	0	+.2
12	Corr. press	psig	70.4	89.5	102.1	108.6	112.3	116.3
13	Disch. head	ft.	162.7	206.9	236	251	259.5	268.3
14	Gage elev. corr.	ft.	+1.6	→	→	→	→	→
15	Corr. disch. head	ft.	164.3	208.5	237.6	252.6	261.1	269.9
16								
17	Velocity head constant	k		36,250,000	→	→	→	→
18	Velocity head	ft.	1.9	1.4	.7	.3	.1	0
19								
20	Total dynamic head	ft.	174.9	217.6	245.2	259	266.8	275
21								
22	Speed	rpm	1,180	1,180	1,183	1,186	1,192	1,192
23	Water power	hp	369	387	321	230	130	0
24	Wire to water effy	%	72	81.3	78.8	67.3	45.7	0
25	Pump effy	%	78.3	88.3	85.7	73.1	49.7	0
26	Volts avg. 3ø	v	442	441	442	440	440	442
27	Amp. avg. 3ø	A	575	536	463	394	333	289
28	Power factor		.87	.87	.86	.85	.84	.83
29	Kw input	kw	383	356	305	255	213	183.5
30	Motor hp input	hp	513	477	408	342	285	246
31	Motor effy	%	92	→	→	→	→	→
32	Motor hp output	hp	472	438	375	315	262	226
33		Test corrected to 1200 rpm						
34	Flow	gpm	8,490	7,170	5,260	3,560	1,943	0
35	Total dynamic head	ft.	180.8	225	252	265	271	279
36	Input power	hp	496	460	391	327	267	230
37	Pump effy	%	78.3	88.3	85.7	73.1	49.7	0
38								
39								
40								
41								
42								
43								

Notes: Mechanical operation normal. 20" mercury column on suction side at side top gage line dry. 0—200 psi gage on disch. at side top calibrated 8/8/57. Plant venturi 16.16" x 11.00" used C = .985, Water 67° F. operation to date 1200 hours.

Correction for flow:

$$\frac{Q_1}{Q_2} = \frac{n_1}{n_2} \qquad (15b)$$

Correction for head:

$$\frac{H_1}{H_2} = \left(\frac{n_1}{n_2}\right)^2 \qquad (15c)$$

Correction for power:

$$\frac{bhp_1}{bhp_2} = \left(\frac{n_1}{n_2}\right)^3 \qquad (15d)$$

The corrections are easily made on a slide rule by utilizing the power ratios of the C-D, A-B, and K scales.

The efficiency will remain unchanged for speed corrections of 10 to 20 per cent, so the efficiency for each point can be noted from the original speed. However, it is often useful to check all corrections by refiguring the efficiency from the corrected results. If the figures are not the same, there has been a "slide rule slip."

Plotting the Results

It is the accepted practice to show pump performance by plotting the results against "flow." One or more curves are drawn: head *vs* flow; efficiency *vs* flow; bhp *vs* flow; or any other desired quantity *vs* flow (Fig. 3). These curves serve very useful purposes. They tend to point out any erroneous test points and give a continuous picture that allows the opera-

tor to cover the full range of a pump's performance with only five to ten points.

When a variable-speed drive is used, it is often useful to plot several different speeds covering the complete range of the driver, which presents a complete picture of the speed and power required to fill each condition of head and flow.

In addition to the test curve, it often will be useful to plot other curves that are calculated from the basic curve and the particular installation. Useful curves are: kilowatt-hours *vs* flow; power cost ($ per day) *vs* flow; time to fill a reservoir *vs* height of the reservoir; or combined head capacity characteristics of several pumps in series or in parallel. Through different types of curves, there is a vast amount of information that can be shown and studied. This information may well form a very useful part of the operation, maintenance, and planning of a pump installation.

Centrifugal Pump Theory

The theory of how a centrifugal pump operates is intimately tied into actual performance. Therefore, a brief review of the basic theory of centrifugal pump operation is in order. The centrifugal pump (see Fig. 3) is a means of converting mechanical energy, the output of a motor or engine, into hydraulic energy in the form of increased head or pressure in the fluid being pumped. Exactly how and where the conversion takes place within the pump has been well covered in numerous articles and texts, and need not be of concern in the actual pump testing.

In simplest terms, the performance of the pump can be expressed as: ENERGY IN WATER AT SUCTION + ENERGY INPUT = ENERGY in WATER AT DISCHARGE + LOSSES.

The energy in water at any time can be represented by Bernoulli's theorem, which states that the total energy per unit is a constant. This concept can be represented by:

$$H = h_s + \frac{V^2}{2_g} + Z \quad \text{(16a)}$$

Multiplying Eq. 16 by the pounds per second flowing through the pipe gives:

$$0.00223\ Q\ w\ H = 0.00223\ Q\ w\ (h_s + \frac{V^2}{2_g} + Z) = 550\ whp \quad \text{(16b)}$$

Table 3

Calculation of Typical Test

(Line numbers refer to horizontal line on data sheet. Numerical examples are for Test Point No. 1)

Line 1. Read in inches of mercury and recorded.
9.5

Line 2. Calculated prior to test and constant for all test points.
2,707

Line 3. Calculated.
Line 2 $\sqrt{}$Line 1 = 2,707 $\sqrt{}$9.5 = 8,350

Line 5. Read in inches of mercury and recorded. Pressure is below atmospheric, so sign is negative.
—7.9

Line 6. Calculated.
1.131 (Line 5) = 1.131 × —7.9 = —9.0

Line 7. Measured prior to test and constant for all readings. Gage line is air-filled, so correction equals distance between gage tape and datum line of pump. Gage is above datum, so correction is positive.
+0.3

Line 8. Calculated.
Line 6 + Line 7 = —9.0 + 0.3 = —8.7

Line 10. Discharge gage read and recorded.
72.6

Line 11. Gage had been calibrated prior to test, correction from calibration curve.
—2.2

Line 12. Calculated.
Line 10 + Line 11 = 72.6 + (—2.2) = 70.4

Line 13. Calculated.
(Line 12) × 2.31 = 2.31 × 70.4 = 162.7

Line 14. Measured prior to test and constant for all readings. Gage line is filled with water, so correction equals distance from centerline of gage to datum line. Gage is above datum, so correction is positive.
+1.6

Line 15. Calculated.
Line 13 × Line 14 = 162.7 + 1.6 = 164.3

Line 17. From Table 2 for 16 by 14 in. pump.
36,250,000

Line 18. Calculated.

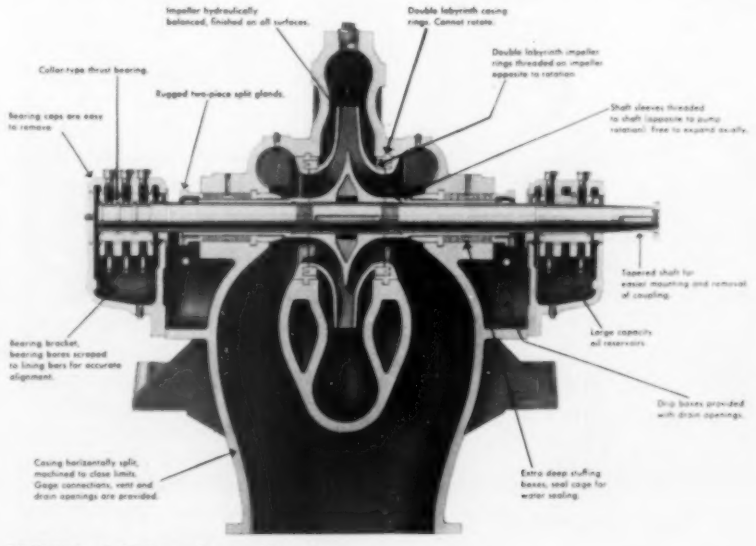
$$\frac{(\text{Line } 3)^2}{\text{Line } 17} = \frac{8{,}350^2}{36{,}250{,}000} = 1.9$$

Line 20. Calculated.
Line 15 — Line 8 + Line 18 = 164.3 — (—8.7) + 1.9 = 174.9

Line 22. Measured and recorded.
1,180

Line 23. Calculated.

$$\frac{\text{Line } 20 \times \text{Line } 3}{3{,}960} = \frac{174.9 \times 8{,}350}{3{,}960} = 369$$


Impeller hydraulically balanced, finished on all surfaces.
Double labyrinth casing rings. Cannot rotate.
Collar-type thrust bearing.
Double labyrinth impeller rings threaded on impeller opposite to rotation.
Rugged two-piece split glands.
Bearing caps are easy to remove.
Shaft sleeves threaded to shaft (opposite to pump rotation) free to expand axially.
Tapered shaft for easier mounting and removal of coupling.
Bearing bracket, bearing bores screwed to lining bars for accurate alignment.
Large capacity oil reservoirs.
Drip boxes provided with drain openings.
Casing horizontally split, machined to close limits. Gage connections, vent and drain openings are provided.
Extra deep stuffing boxes, seal cage for water sealing.

DESIGN of 100 mgd centrifugal pump.

Table 3 (Continued)

Calculation of Typical Test

(Line numbers refer to horizontal line on data sheet. Numerical examples are for Test Point No. 1)

Line 24. Calculated.

$$\frac{\text{Line 23} \times 100}{\text{Line 30}} = \frac{369 \times 100}{513} = 72$$

Line 25. Calculated.

$$\frac{\text{Line 23} \times 100}{\text{Line 32}} = \frac{369 \times 100}{472} = 78.3$$

Line 26. Measured, averaged, and recorded.
442

Line 27. Measured, averaged, and recorded
575

Line 28. Measured and recorded.
0.87

Line 29. Calculated.

$$\frac{\text{Line 26} \times \text{Line 27} \times \text{Line 28} \times \sqrt{3}}{1{,}000} = \frac{442 \times 575 \times 0.87 \times 1.732}{1{,}000} = 383$$

Line 30. Calculated.
Line 29 × 1.341 = 383 × 1.341 = 513

Line 31. Motor efficiency from motor manufacturer's data as a function of Line 30 or as a constant.
92

Line 32. Calculated.

$$\frac{\text{Line 30} \times \text{Line 31}}{100} = \frac{513 \times 92}{100} = 472$$

Line 34. Calculated for 1,200 rpm.

$$\text{Line 3} \left(\frac{1{,}200}{\text{Line 22}}\right) = 8{,}350 \left(\frac{1{,}200}{1{,}180}\right) = 8{,}490$$

Line 35. Calculated for 1,200 rpm.

$$\text{Line 20} \left(\frac{1{,}200}{\text{Line 22}}\right)^2 = 174.9 \left(\frac{1{,}200}{1{,}180}\right)^2 = 180.8$$

Line 36. Calculated for 1,200 rpm.

$$\text{Line 32} \left(\frac{1{,}200}{\text{Line 22}}\right)^3 = 472 \left(\frac{1{,}200}{1{,}180}\right)^3 = 496$$

Line 37. Calculated for 1,200 rpm as a check on Lines 34, 35, and 36, and should agree with Line 25.

$$\frac{\text{Line 34} \times \text{Line 35} \times 100}{\text{Line 36} \times 3{,}960} = \frac{8{,}490 \times 180.8 \times 100}{496 \times 3{,}960} = 78.3$$

In Eq. 16*b*, 0.00223 Q represents the cubic feet per second flowing in the pipe if Q is in gallons per minute; 0.00223 Q w is the pounds of water per second. The term h_g represents the pressure as read from a gage or manometer, in feet of head or static head. $\frac{V^2}{2g}$ represents the portion of the head in the form of velocity energy. Z represents the elevation above or below a given datum. This factor is necessary because the amount of energy in a given flow in a pipe depends on the pipe level; there is much greater energy if the reference plane is at a level some feet below the pipe. Whp represents the actual horsepower in the water under the prescribed conditions.

As an example, in any one pump the quantity of water flowing in at the suction and out at the discharge is a constant. The change of pressure read on the gage represents the increase in static pressure. The velocity will normally be different in the suction and discharge pipes because of the smaller diameter of the discharge. Because the elevations of the two gages may be different, there may be different distances to the datum line. The equation for the flow in the suction pipe subtracted from the equation for flow in the discharge pipe will represent the increase in energy across the pump:

$$0.00223\,Q\,w\left(h_{gd} + \frac{V_d^2}{2g} + Z_d\right) - 0.00223\,Q\,w\left(h_{gs} + \frac{V_s^2}{2g} + Z_s\right) = 550\,whp \quad (17a)$$

TABLE 4
Velocity Head Constants for Common Pump Sizes* $h_v = \frac{Q^2}{K}$

Pump Suction Dia., in.	Pump Discharge Dia., in.	Vel. Head Constant, K
2	1	413
2	1½	2,830
2½	2	10,600
3	2	7,700
3	2½	29,300
4	2	6,580
4	3	45,500
5	3	36,000
5	4	167,000
6	3	33,250
6	4	123,000
6	5	435,000
8	4	105,800
8	5	285,000
8	6	733,000
10	4	101,200
10	5	257,000
10	6	575,000
10	8	2,680,000
12	8	1,970,000
12	10	7,500,000
14	8	1,768,000
14	10	7,400,000
14	12	17,350,000
16	10	4,550,000
16	12	11,700,000
16	14	36,250,000
18	16	67,000,000
20	18	118,600,000
24	20	119,150,000
30	24	217,000,000
36	24	160,000,000
36	30	606,000,000

*Constants for other sizes of pumps can be calculated from

$$K = \frac{385.6}{\frac{1}{D_d^4} - \frac{1}{D_s^4}}$$

in which D_d is the discharge diameter and D_s is the suction diameter, both in inches. The equation has been derived from the basic relationship $h_v = \frac{V_d^2}{2g} - \frac{V_s^2}{2g}$.

Rewriting Eq. 12 for water at 68F:

$$(h_{gd} + Z_d - (h_{gs} + Z_s) + \left(\frac{V_d^2 - V_s^2}{2g}\right) = \frac{550\,whp}{0.00223\,Q\,w} = \frac{3{,}960\,whp}{Q} \quad (17b)$$

The left-hand portion of Eq. 17*b* is known as the "total dynamic head." $(h_{gd} + Z_d)$ is the reading on the discharge gage, converted to feet of water and corrected in elevation to the datum, normally the horizontal centerline of the pump; $(h_{gs} + Z_s)$ is the reading on the suction gage converted to feet of water and corrected in elevation to the datum. The datum must be the same for both the suction and discharge readings. $\left(\frac{V_d^2 - V_s^2}{2g}\right)$

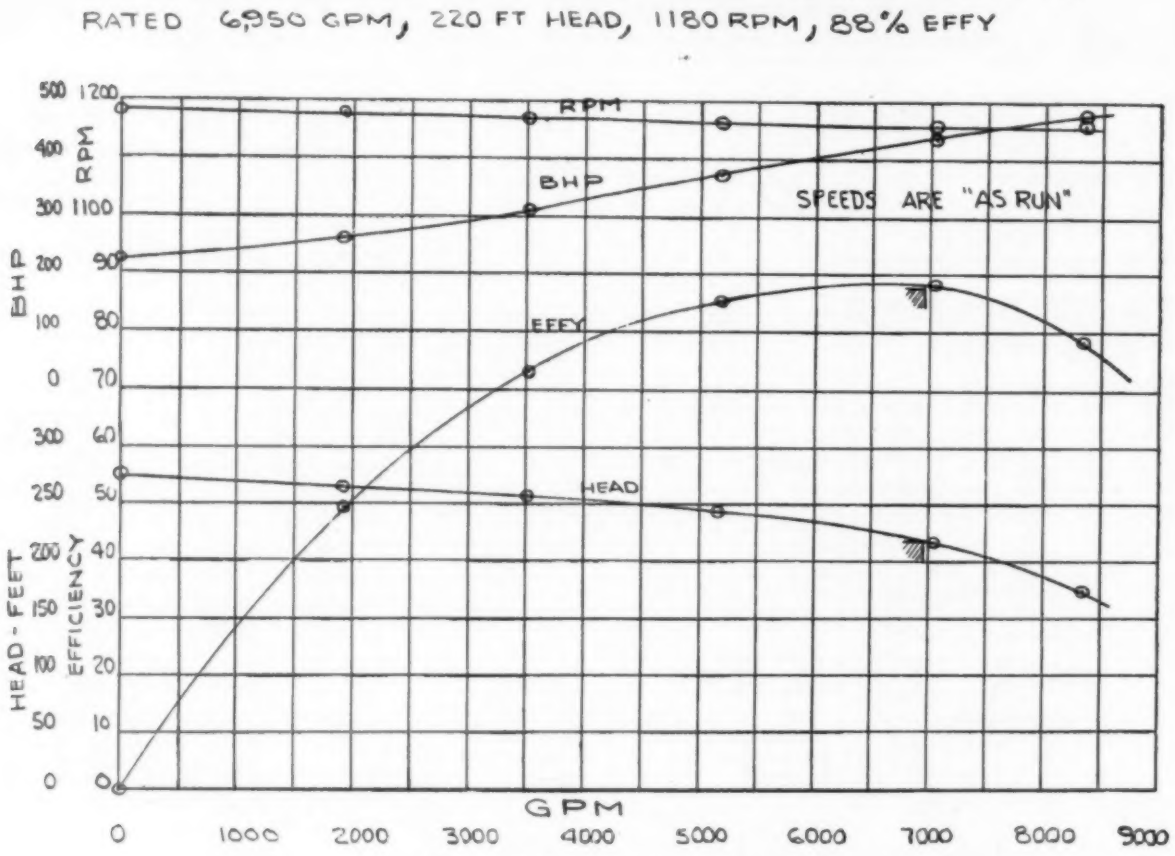


FIG. 3—Typical pump test curve.

is the change of velocity head in feet of water and is calculated from the pipe sizes and flow. The three combined are the total dynamic head:

$$H = (h_{od} + Z_d) - (h_{os} + Z_s) + \left(\frac{V_d^2 - V_s^2}{2_g}\right) \quad \text{.....(18)}$$

Substituting in Eq. 17*b* gives:

$$whp = \frac{H\,Q}{3{,}960} \quad \text{.....(19)}$$

Pressure has been expressed in terms of feet of head rather than pounds per square inch. Pump engineers prefer to use feet of head for several reasons. First, it simplifies all elevation corrections. The discharge of a centrifugal pump at a given speed and capacity is a definite head in feet, regardless of the temperature or the specific gravity of the liquid. Because most gages read in pounds per square inch, it will be necessary to convert back and forth from psi to feet. This can be done easily by:

$$h_o = \frac{144\,p_o}{w} \quad \text{.....(20a)}$$

$$p_o = \frac{h_o\,w}{144} \quad \text{.....(20b)}$$

Unfortunately, not all of the power imparted to the shaft of a pump is converted to useful pump output (whp). Some of it is dissipated as heat in the bearings due to friction, some as heat at the packing or shaft sleeves, and still more as friction between the pump and the water or friction in the water itself. Other power is lost by leakage from the discharge portion of the pump back to the suction through the impeller rings and breakdown bushings.

The less these losses are, the greater the efficiency of the pump. Written as an equation:

$$E_p = \frac{whp}{bhp} \times 100 \quad \text{.....(21)}$$

in which whp is the power output and bhp is the power input. This efficiency is the measure of how good a given pump is—or how bad it is—at a given capacity. The determination of the efficiency is one of the prime reasons for testing. Comparatively, it is the best indication of the internal condition of a pump.

References

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2. "Standards of Hydraulic Institute, Centrifugal Pump Section." Hydraulic Inst., 90 West St., New York, N. Y.
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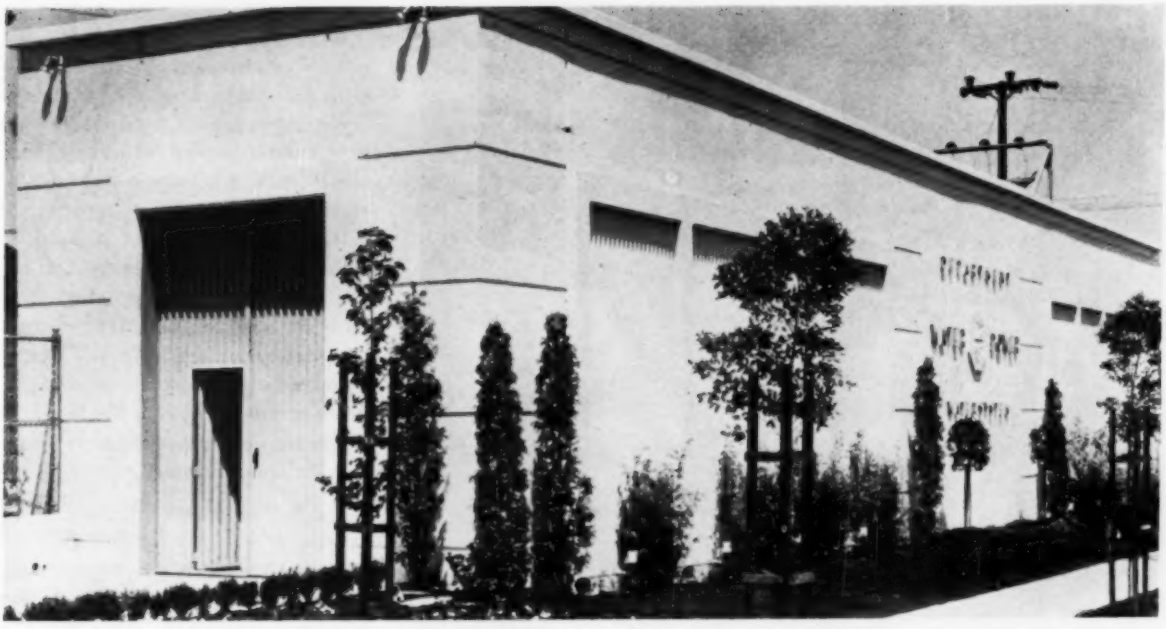


San Pedro, Calif., water pumping facilities had to be housed in a very narrow building which necessitated

Vertical-Mounted Horizontal Pumps

EDITOR'S NOTE: All the features of a particular horizontal pump may be obtained with a substantial saving in floor space by mounting the pump vertically. This adaptation is equally successful for existing facilities as well as those in the planning stage. The information on this application and the photographs were supplied by C. H. Wheeler Mfg. Co. of Philadelphia, Pa.

■ IN THE PAST SEVERAL YEARS, industrial growth has been so substantial that many plants are faced with a serious shortage of floor space. As consumer demand and industrial expansion continue, the situation threatens to become worse rather than better.

This shortage is particularly critical when a plant must install additional machinery or pumps in an existing area. It is a worrisome thing even when the physical plant is to be enlarged, because of constantly-rising construction costs.

Minimum Space Used

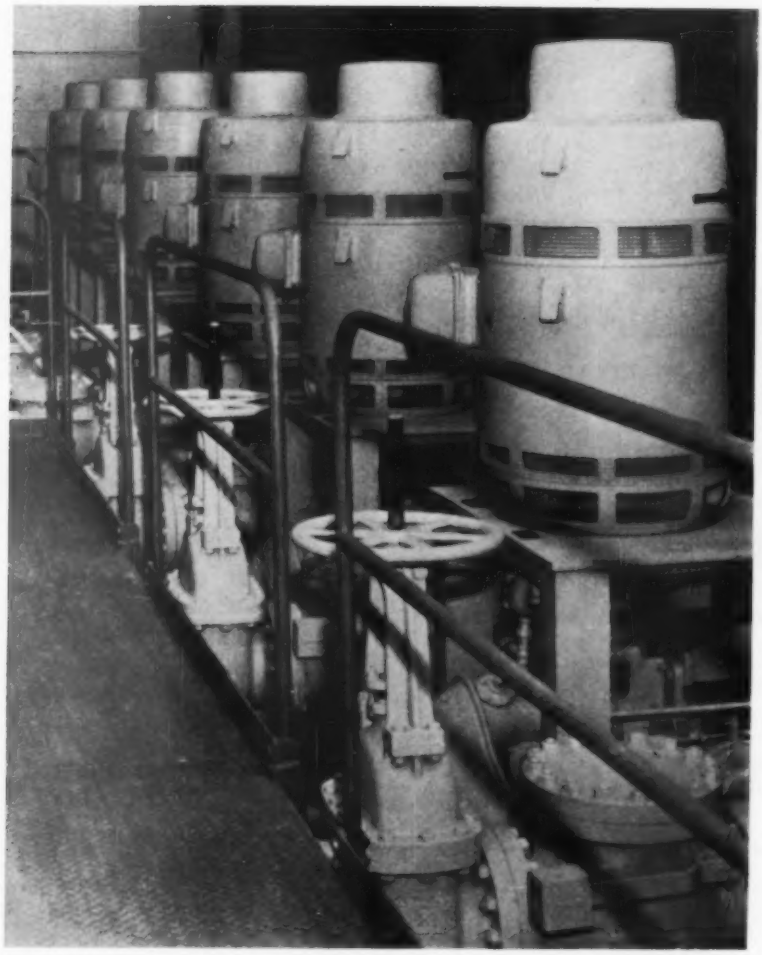
One ingenious method of installing pumps provides a 50% saving in floor area. Such savings have been realized by many water works, among them that of the City of Los Angeles. By vertically mounting horizontal pumps, utilities have obtained the pump size, capacity, and the head they want, along with the type pump they need —but with a substantial area saving.

At a large Mid-western station, four double suction pumps, mounted vertically, have been in operation for more than two years. Two of the units, 10 in. x 8 in. double suction pumps, powered by 200 hp, 1750 rpm motors, have been in use even longer. These pumps deliver 2320 gallons per minute and have a 277-ft total dynamic head, and are equipped with vertical, drip proof, squirrel cage motors. The other two units were 18 in. x 14 in. double suction pumps powered by 600 hp, 1170 rpm motors. These units deliver 6980 gallons per minute and also have a 277-ft TDH.

These units were installed in a new pump room where it was desirable to save floor space.

Simple Conversion

Only a minor pump modification is required to convert horizontal pumps to vertical operation. During assembly the thrust bearing is placed between the motor and the impeller, instead of outboard as is standard in horizontal construction. The bearing normally placed inboard, in turn is



VERTICALLY mounted horizontal pumps installed in narrow station at San Pedro pumping station in California.

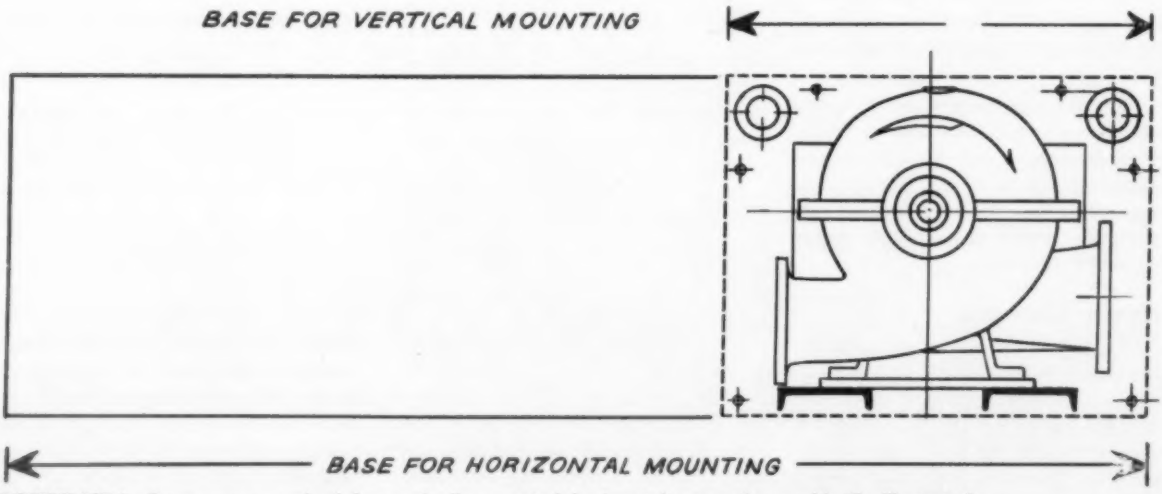
located where the thrust bearing usually is. No other changes are necessary.

Los Angeles Experience

In California, Marvin Owen, Senior Mechanical Engineer for the Los Angeles Department of Water and Power, used the same method—with equally good results. In the Los Angeles San Pedro water supply installation, there are six horizontally split case pumps mounted vertically. Three are 10 in. x 8 in. single-stage double suction pumps with a capacity of 3200 gpm each against a head of 240 ft. They are driven by 250 hp, 1750 rpm motors. The other three units are 8 in. x 6 in. DMD two-stage pumps, powered by 300 hp, 1750 rpm motors. Each pump delivers 1500 gallons per minute with a 460 ft TDH. These units have now been in operation for almost a year.

Horizontal pumps mounted vertically were selected for this new installation because of the confined area. The site available for the new station was limited, and floor space was at a premium. The vertical installation proved to be practical and efficient as well as space saving. Steep head capacity curves with corresponding high shut-off head eliminated the use of vertical turbine type pumps.

Because of the minimum area which vertical installation utilizes, it is safe to assume vertical mounting of horizontal pumps will receive careful consideration by many other pump operators in the future. Neither pump performance nor dependability suffers from the conversion. The technique has application with many types of pumps in a wide size range.



DIFFERENCE in floor space required for vertically mounted horizontal pumps is graphically illustrated.

A Modified Winkler Method Using Sulfamic Acid for . . .

Dissolved Oxygen Determination

by ISADORE NUSBAUM, Senior Water Pollution Control Engineer, Calif. Water Pollution Control Board #9, San Diego, Calif.

EDITOR'S NOTE: The author suggests a new modification to the Winkler Method by substituting sulfamic acid for concentrated sulfuric acid. Comparative analyses showed no significant difference in results obtained using the two acids.

The advantages in using either the crystalline or solution form of sulfamic acid in laboratory and field applications are described.

■ THE USE OF SULFAMIC ACID as a replacement for sodium azide in the modified Winkler method for dissolved oxygen in samples containing nitrites was recommended by Cohen and Ruchoft.[1] It was also shown that sulfamic acid could be effectively used to preserve biologically active samples for a delayed dissolved oxygen determination. The procedure recommended had no specific advantage over the azide modification of the Winkler method[2] and actually required the preparation of a special reagent and an extra step in the analysis.

The transport and use of sulfuric acid in the dissolved oxygen method particularly in field work has been a source of aggravation and has resulted in damage to equipment, clothes and person in a great many instances.

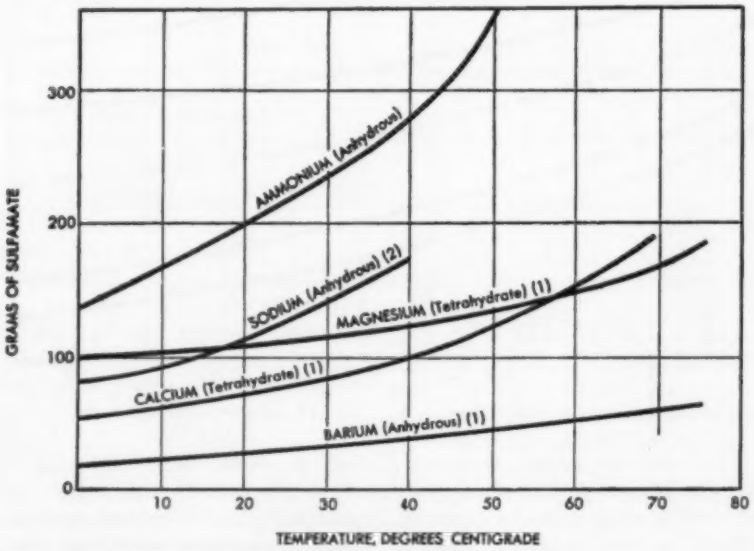


FIG. 1. SOLUBILITY of Sulfamates Grams/100 grams water

Even in the laboratory the use of concentrated sulfuric acid in the Winkler determination has made more than usual caution necessary. Hydrochloric and ortho phosphoric acids have been substituted for sulfuric acid but increased volumes are required. These acids are not without problems as well.

Availability of Acid

Sulfamic Acid (NH_2SO_3H) is a readily available, inexpensive, relatively non-hazardous white crystalline solid acid.[3] It is non-volatile and non-hygroscopic. Sulfamic acid has been shown to be close in strength to sulfuric, hydrochloric and nitric acids yet it is much less corrosive. The calcium, barium and magnesium salts of sulfamic acid are quite soluble. Figgures 1, 2 and 3 show the solubility of the acid in water, its comparative strength and the solubility of some of the salts.

One of the important industrial uses of sulfamic acid is based on the ability to remove nitrites and nitrous acid from solution.

$$HOSO_2NH_2 + HNO_2 \rightarrow H_2SO_4 + H_2O + N_2\uparrow$$

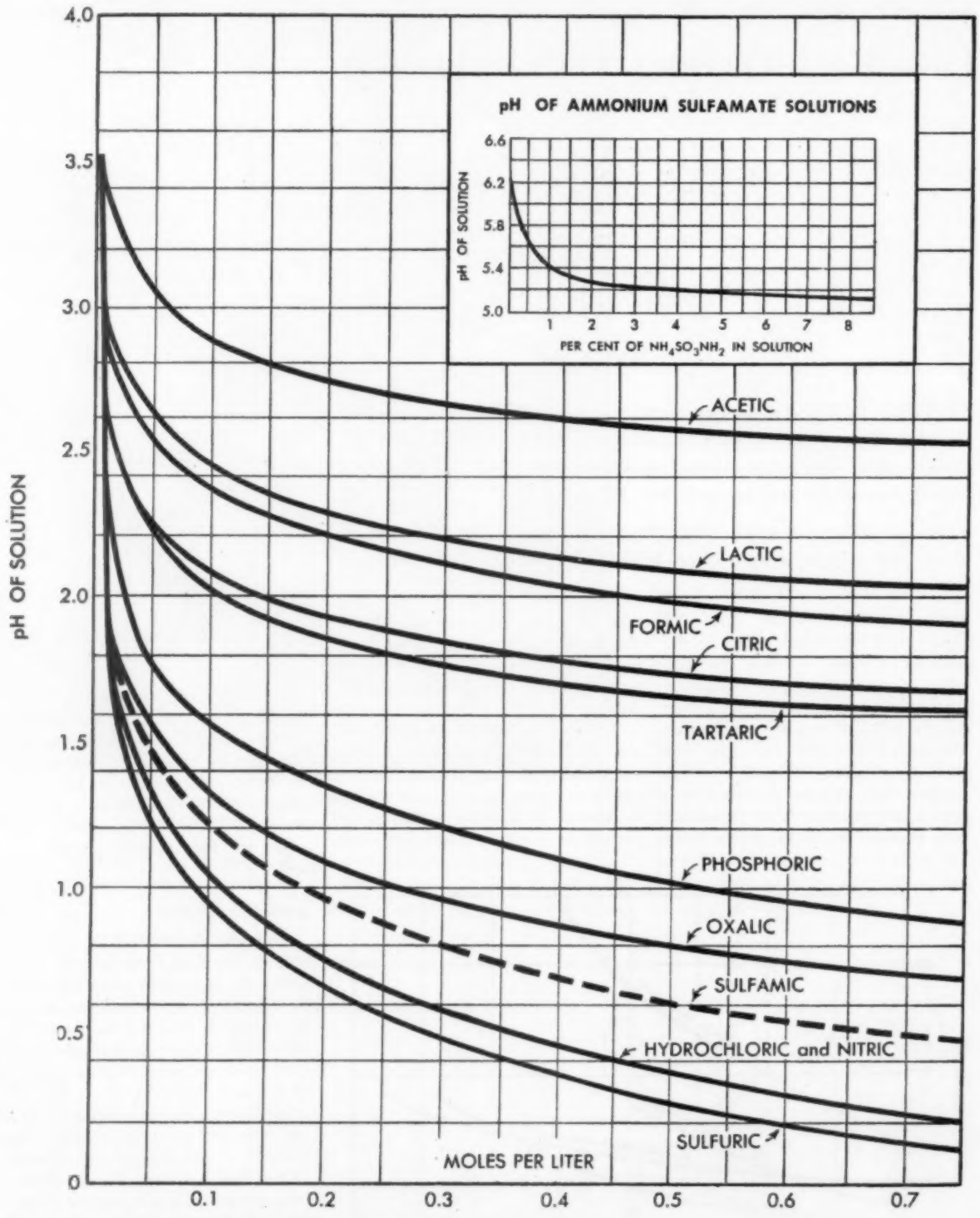


FIG. 2. pH CONCENTRATION Curves Comparing Sulfamic Acid with Other Acids

Sulfamic Acid is reported as two to six times more effective than urea for this purpose and about two-thirds as effective as sodium azide in the modified Winkler method.[1]

The dissolved oxygen determination was modified first by directly substituting sulfamic acid for sulfuric acid in the procedure. The sulfamic acid was added as a solid. A stainless steel or plastic measuring spoon of the ½ teaspoon size was found to be satisfactory and contained approximately four grams when filled level. This was enough to neutralize 2 ml

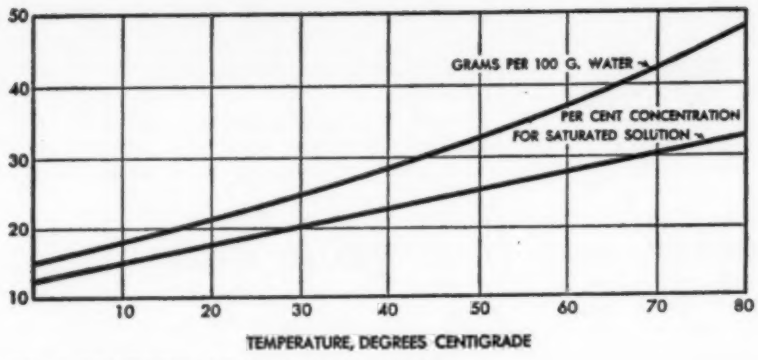


FIG. 3. SOLUBILITY of Sulfamic Acid in Water.

of the alkaline-iodide reagent and acidify the sample. A small amount of the crystalline acid will remain within the cupped area of the conventional B.O.D. bottle. It is not necessary to force all of this material into the bottle. The ground glass stopper may be replaced and the sample shaken.

The possibility of an error due to interstitial air in the solid acid was investigated and no significant difference between samples acidified with either sulfuric or sulfamic acid was found. Some comparative analyses are:

Dissolved Oxygen (mg/L)

Sample	Acidified with: H_2SO_4	NH_2SO_3H
BOD water	8.0	8.0
Tap water	9.2	9.2
BOD water	8.15	8.1
Prim. eff.	0.1	0.1
Prim. eff. & BOD water	5.0	5.0
BOD water	8.1	8.1
BOD water	7.9	7.9

Nitrite Interference Absent

The possibility that the sulfamic acid would destroy nitrites under the circumstances described above and thus eliminate the nitrite interference to the D.O. determination was then investigated. The nitrite interference does not occur in the dissolved oxygen method until the final acidification. The nitrites in acid solution then react with potassium iodide to produce iodine as in the following equation:

$$2I^- + 2NO_2^- + 4H^+ \rightarrow 2H_2O + 2NO + I_2$$

The reaction of sulfamic acid with nitrite appears to be slower normally than the reaction of nitrite and iodide ions in acid solution. When a solution of sodium nitrite and potassium iodide in distilled water is acidified with sulfamic acid, copius amounts of free iodine are released. However, in the dissolved oxygen determination a different condition exists. The sample is strongly alkaline before acidification and, therefore, the change in pH is more gradual upon the addition of the sulfamic acid. The reaction between nitrite and iodide requires a pH of about 3. The sulfamic acid, therefore, has an opportunity to react with the nitrite ion and destroy it before the nitrite-iodide reaction takes place. Several of the determinations in Table 1 were run with an additional sample containing several parts per million of nitrite ion. No significant nitrite error was found when sulfamic acid was used to acidify the sample, as shown by these data.

Apparent Dissolved Oxygen (mg/L)

Sample	Nitrite Added		No Nitrite
Acidified with:	H_2SO_4	NH_2SO_3H	NH_2SO_3H
BOD water	9.6	7.9	7.9
Prim. Eff.	8.8	0.4	0.4
BOD water	10.3	8.1	8.1

The solutions and procedure suggested for setting up a sample for the determination of dissolved oxygen, particularly in field work, would follow the unmodified Winkler method[2] with regard to the manganous sulfate solution and the alkaline-iodide reagent. Instead of the concentrated sulfuric acid, ½ level teaspoon or 4 grams of sulfamic acid are added to a 250 to 300 ml sample. The sample is vigorously shaken and titrated as normally. It is not necessary to add sodium azide to the alkaline-iodide reagent.

Field Kit

In setting up a field kit for dissolved oxygen analyses, several ideas have been tried and successfully used which might be of value to others. The writer has used a solid soluble starch available almost everywhere instead of the conventional starch indicator solution. The material is known as Niagara Soluble Starch and is soluble in cold water, stable and quite inexpensive. A small amount of the solid is added to the sample being titrated before the endpoint is reached. The starch-iodine complex has a slight blue-pink color near the endpoint but the endpoint is sharp and easy to see. An inexpensive but effective substitute bottle has been used for both dissolved oxygen and B.O.D. analyses. A conventional 24 or 28 mm screw cap, round or square form bottle of 8 ounces capacity is used in conjunction with a 24 or 28 mm Polyseal plastic cap. The cap is made of a hard plastic with a conical polyethylene inner seal. No air is entrapped when a full bottle is sealed with a Polyseal enclosure. Bottles and caps may be obtained separately and are very inexpensive. When used for the B.O.D. determination no water seal is necessary. Occasionally a vacuum will be created within the bottle during a B.O.D. incubation which may cause the inner conical liner to separate when the cap is removed. This has not proved to be a serious problem. The bottles will contain about 250 ml and have been found to be blown to as close volumetric tolerance as the ordinary B.O.D. bottle.

Acknowledgment

The assistance of Ken Morikawa, Chemist, San Diego Sewage Treatment Plant, is gratefully acknowledged. The sulfamic acid was supplied by the Braun Corp., Los Angeles, California.

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Meeting at Lake Placid Club featured . . .

Water Works Financing *and Inadequate Rates*

EDITOR'S NOTE: The subject of Water Works Management is now receiving considerable attention by the American Water Works Assn. in its "Operation Water Works Advancement." Among the important phases of management of both public and private utilities is the problem of obtaining money for expansion of facilities and for operation. At the recent meeting of the N. Y. Section of AWWA, these topics were explored and discussed as a part of the "Water Works School" session which is a regular feature of this Section's meetings. Two "lectures" presented at this "school" are reported here at some length.

■ Financing Water Works Projects by Frances Stone, Consultant, Water Group Advisory Service, New York City.

"The tremendous growth in demand for water in the next 17 to 22 years presages a huge outlay of money for capital improvement. More than $45 billion must be expended for water and sewage works facilities in order to supply water demands of 472 bil gal a day by 1975 and 500 bil gal a day by 1980." So spoke Dr. Stone, who was the first of two "lecturers" on the "Water Works School" Session of the N. Y. Section AWWA Meeting.

Add to these needs the present backlog of needed construction of $5.76 billion and it is apparent that the projected demands and needs for capital investment amount to an expenditure of $2.55 billion a year for the next 20 years. Compared to our present rate of spending for construction ($1.5 billion in 1956, $1.7 billion in 1957, and an estimated $2.0 billion in 1958) it appears that the backlog of demand for construction, expansion and replacement will continue to grow unless these needed projects are undertaken soon. Inasmuch as these values are based on current prices, it is to be expected that these amounts will increase since inflation will continue over the coming years.

Where will the money come from to finance these needed expenditures? There are two major categories, first, internal and second, external. Water rates provide the internal sources of money. External sources include the Federal government and private investors. P.L. 660 provides some money for sewage works and the Housing and Home Finance Administration, through its Communities Facilities Administration is empowered to buy securities issued for water supply and sewage works developments.

Dr. Stone suggested that where local industry benefits from water and sewage facility improvement, it might be possible to sell securities to these local industries, which might find such securities a good place to invest pension funds.

As to the municipal bond market, now about $7 billion a year, approximately $2.2 billion are in revenue bonds and 50 per cent of these are for water and sewage projects. Dr. Stone expects that water and sewage works revenue bonds will go to $2 billion a year and then to $3 billion in the next several years.

One advantage of municipal bonds to the investor is that they are tax exempt. To the municipality, this means that the bonds can be sold at a lower interest rate.

There are two ways in which the cost of obtaining money can be kept down, first obtain all the information and data possible on the project, and secondly plan ahead for 10 to 20 years at least. Where there are several small communities, it may be feasible and less costly both for construction of facilities and for obtaining money, if they will band together. Once the plans are set both the time of financing and the time of construction can be set.

For the future, Dr. Stone sees greater planning and expenditure on both the Federal and local levels, for these reasons:

1. Greater realization that water is a vital resource of this country and that to obtain it requires money.

2. An increasing awareness by the investing public of the attractiveness of debt securities with tax exemption.

3. The Federal Government will probably pass laws to enable investment funds to pass along the tax exemption feature to shareholders.

4. Planning based on fundamental information is the surest means of securing funds at a reasonable cost.

Water Rates

■ INADEQUATE WATER RATES—SYMPTOMS AND TREATMENT by John H. Murdoch, Jr., Consultant, Wynnewood, Penna.

"Water rates are adequate when the revenues they produce, when properly applied, under normal conditions are sufficient to cover proper fixed charges and proper operating expenses, with enough excess to enable the enterprise to be financially sound, and capable of expanding as demands for service change or grow." This was the definition of adequate water rates; any rates insufficient in any respect to meet all of these requirements are inadequate.

Mr. Murdoch analyzed the elements of this definition. With respect to *"proper application,* rates are inadequate if the customers are not billed in accordance with the design of the rate schedule—if through favoritism or carelessness customers are undercharged, the required revenue may not be produced."

With respect to *"normal conditions,"* rates should be adequate for average situations. "A depression, an industrial strike or weather conditions may, for a period, cause severe lowering of water use by customers and result in such a reduction in revenues from water sales that they fail to cover all costs. To the extent that the circumstances are unusual, infrequent, and of short duration, conditions are not normal and there may be a stringency. However, some short years, some set-backs, must be expected and enough excess must be secured in good years to keep the enterprise healthy in the occasional lean year. In short, normal conditions must include bad as well as good periods. Rates fixed with an eye only for good years may be disastrous."

With respect to *"proper fixed charges,"* Mr. Murdoch said, "fixed charges such as interest sinking funds and amortization must be met. If they are incorrectly computed or made unnecessarily high, they are just as improper as they would be if on the low side; therefore rates must cover proper charges.

"Proper operating expenses, (e.g. wages, salaries, rent, materials, power, taxes and depreciation) must be covered by revenue and the rates must produce enough revenue to cover proper expenses but not on those which are unnecessary or improvident.

"On the other hand, expenses may be improper because they are too low. Pinch penny, penurious operation management resulting in poor service, poor maintenance, and underpaid and poorly trained officers or employees, reflect improper operating expense.

"Proper fixed charges and proper operating expenses are those required for the rendering of adequate water services.

"Revenues are inadequate if they are not sufficient to yield enough excess, for revenues merely sufficient to cover proper charges and proper expenses are not enough for healthy operations. They do not give a municipal system the financial strength required to meet emergencies or to meet expanding demands or to make their securities salable in the money markets. Public systems must have a substantial cushion over all their charges and costs, for otherwise services will suffer.

"As to privately owned water companies the same is true. Furthermore, their present owners must be treated as well as in the way of dividends and coverage, as the investors who must be attracted to the enterprise to keep it expanding with demand.

"In summary, the symptoms of inadequate rates, characterized by an inability to meet fixed charges, to meet operating expenses, to offer adequate service, to attract and hold good employees, to grow, to give fair compensation to investors, and to attract new capital.

"These symptoms are not always proof of inadequate rates; they may be due to other causes, for example: 1. A financial structure of poor design calling for refinancing on a sound basis; 2. Poor operating management —inefficient pumps, too many man hours per unit and poor engineering.

"Abundant revenues do not guarantee adequate service—poor management can make a shambles out of a financially strongly backed water works."

Treatment Indicated

In answer to the question, "What treatment is indicated?" Mr. Murdoch said:

"1. *Assemble the facts.* Get all available facts.
   a. Balance sheet, all data on financial structure-type of securities outstanding, dates, due dates, call dates and provisions, interest rates, sinking funds.
   b. Revenues and expenses tabulated by accounts over a period of several years.
   c. Similar study of excess revenues over expenses, if any and comparison of excess with fixed charges.
   d. Several years data on numbers and classes of customers, consumption in total and by classes. (To determine sound rate structure).
   e. Several years study of operating data on unit costs of service both in dollars and in man-hours, power and materials.

"2. *Study the facts* to determine whether and when these may be weaknesses which could be overcome and which may be false symptoms of inadequate rates.

"3. Have your studies, data and facts reviewed and, when necessary, revised by advisors who know what is sound.

"4. Determine where and how the system needs improvement physically, its costs and the benefits to the people from the needed improvements.

"5. Once the facts and needs are known and all the weaknesses recognized and either overcome or their cure suggested and properly discounted, let the public know why and how much rates must be increased to give them proper service—to make rates adequate.

"6. Present your case to the governing or regulatory body having jurisdiction.
   a. A clear exposition of your request.

b. Exhibits to show all the facts needed for clear understanding.
c. Exhibits so neatly prepared and so captioned and arranged that a minimum of verbal explanation will be required.
d. Exhibits arranged in logical order, tied in with statements, all leading from present physical plants, through financial statements, operating revenues and expenses both actual and proforma to reflect known changes in conditions, estimate of revenues under the proposed rates, to a final showing of the excess over all charges and the need for such excess, probably showing improvements contemplated.

"7. Expect to be cross-examined and be prepared to give honest frank answers. Know why certain data are out of line and what is to be done.

"8. Be a salesman for Water Works Advancement."

These presentations by Dr. Stone and Mr. Murdoch were made as "lectures" in the Water Works School Session which is a regular part of each meeting of the N. Y. Section. These "school sessions" are presided over by Dr. George E. Symons, Editor, WATER & SEWAGE WORKS, who opened this particular session by presenting data to show that the income per dollar of fixed assets in water utilities is but a small fraction of the income per dollar of fixed assets of gas and electric utilities. It is because of these low rates for water that water utilities find it difficult to maintain adequate operations and expand as the demand for water grows.

Causes and Cures of Tastes and Odors in Water

At the N. Y. Section AWWA meeting in Lake Placid, N. Y., E. A. Sigworth of the Industrial Sales Div. of West Virginia Pulp & Paper Co., compared taste and odor problems in New York State with the situation in over-all United States. Mr. Sigworth reported on a survey which he had conducted of 241 plants employing treatment for taste and odor removal.

The survey indicated that causes of tastes and odors were due to:

Diatoms—321 cases
Protozoa—205 cases
Blue green algae—198 cases
Green algae—114 cases
Fungi—26 cases

Out of 241 plants, 198 reported algae problems. Odor types due to decaying vegetation were reported as musty (69 plants), earthy (28 plants), woody (20 plants), moldy (17 plants) and swampy (12 plants).

One-third of the replies indicated that the causes of taste and odors were due to actinomycetes, one-third of the replies believed algae to be the cause, and one-third did not know which was the cause.

Tastes and odors due to industrial wastes are caused by phenols (38 cases), chemicals (20 cases) and oil refineries (18 cases). Results of treatment are indicated by the following data:

Success of Treatment— (% of Plants)			
Algae Odors—198 plants			
Type of Treatment	**Complete**	**Partial**	**None**
Activated carbon	90%	9%	1%
Free Residual Cl_2	13%	44%	42%
Super and de chlorination	24%	41%	34%
Chlorine Dioxide	13%	25%	62%
Aeration	11%	53%	36%
Decaying Vegetation—162 plants			
Activated Carbon	92%	7%	1%
Free Residual Cl_2	16%	43%	41%
Super and de chlorination	30%	25%	45%
Chlorine Dioxide	14%	19%	67%
Aeration	6%	47%	47%
Trade Wastes—92 plants			
Activated Carbon	68%	28%	4%
Free Residual Cl_2	19%	35%	45%
Super and de chlorination	17%	33%	50%
Chlorine Dioxide	49%	24%	26%
Aeration	14%	43%	43%

Chlorine dioxide is a specific for phenol odors. The data from New York State were generally of the same order as the whole country with some variations.

"Chlorinous odors are becoming a problem and there is a trend to ammonia-chlorine treatment" was the concluding remark in this presentation.

Water Conservation and Planning in New York

There has been introduced into the N. Y. State Legislature, a study bill "to amend the conservation law, in relation to water resources planning and development membership and duties of the water power and control, the creation of regional planning and development boards and making an appropriation for the expenses thereof with provision for 25 per cent reimbursement by counties."

Senator Wheeler Milmoe, Chairman of the Joint Legislative Committee on Natural Resources discussed the provisions of the bill which will be presented to open hearings in the next several months and will be revised for presentation to the N. Y. State Legislature next year.

The purpose of the bill is to develop water supply for all uses. One provision gives prior claim to public water supplies; existing rights are preserved and no new rights will be established.

Pickups from Purdue Sanitary Enginering News

Anyone who thinks he's indispensable should stick his finger in a bowl of water and notice the hole it makes when he pulls it out.

* * *

The year 1957 represents the 80th year that the Marion (Indiana) Water Works has been operated and owned as a city utility. It was in 1877 that the City of Marion purchased the then privately owned plant.

* * *

Attempts have been made to isolate Salmonella bacteria, including the typhoid organism, from 142 samples of irrigation water contaminated with a chlorinated primary effluent. By improvement of the methods used it was possible to isolate these pathogens from nearly 80 per cent of the samples of water examined.

* * *

Surface reaeration rates in water polluted with domestic sewage have been reexamined. Domestic sewage was found to cause a decrease in reaeration, and as the pollution becomes heavier, reaeration is greatly affected.

Annual meeting drew large attendance to hear papers on . . .

LIQUID ALUM, *Electrolysis and other topics*

EDITOR'S NOTE: At the annual meeting of the NEWWA, held in Poland Spring, Me., the program included four technical sessions and thirteen papers. Five of these papers are reported here. Included are abstracts of papers on liquid alum, electrolysis, New Haven, Conn. water supply, ground water in buried valley deposits, valve operators and supervisory control.

■ INVESTIGATION OF LIQUID ALUM FLOW MEASUREMENT by Kenneth F. Knowlton, Supt., Salem-Beverly Water Supply Board, Beverly, Mass. and Russell H. Babcock, Mgr., Water and Waste Div., Foxboro Co., Foxboro, Mass.

The evaluation determining the use of liquid alum at the Salem-Beverly Water Works was based on availability, cost and ease of handling. Dry alum was purchased at a cost of 39.40 $/ton and the equivalent dry alum in liquid form could be purchased at a cost of 34.00 $/ton which realized a yearly saving of $1,620. Liquid alum, filtered and adjusted to constant 8 per cent strength, was available from a nearby chemical industry and could be delivered in tank truck lots. Ease of handling was assisted by adaptation of the Foxboro Co., Integral Orifice d/p Cell transmitting device for volumetric measurement and feeding based on plant influent.

The use of liquid alum was found to exert additional savings in alum consumption during winter months based on previous plant experience as follows:

		Alum Consumption Jan., Feb., Mar.	Avg. lb/mil gal/yr
	Year		
	1952	304	235
Dry	1953	276	217
Alum	1954	305	242
	1955	251	206
Liquid	1956	180	170
Alum	1957	181	188
	1958	189	———

Liquid alum is fed from a 5,000 gal storage tank and controlled by an air control valve which is nearly closed at 3 psi and wide open at 15 psi.

No stratification in alum concentrations has been noted in the storage tank. Alum deliveries by tank truck and liquid transfer by lead pipe to the plant storage tank are frequent enough to assume sufficient mixing of storage tank contents to prevent any stratification. The temperature of the stored liquid has never dropped below room temperature but considerable feeding problems could be expected if the liquid temperature were allowed to fall below 40°F. No appreciable effects on viscosity have been noted in the 80° to 100° range.

Since Chicago reported difficulties of crystaline formation in the rotameter method of volumetric measurement, the orifice method was studied and used. The standard 0.159 orifice, has a maximum-minimum alum flow feed of dry alum equivalent of 12,500 lb/day to 46.4 lb/day at pressure feed differentials of 250 to 2 inches of water. The 8 per cent strength liquid alum was used in the studies. If standard pressures are used, the increased feed range must be obtained by substituting larger orifices.

The equipment at the Salem-Beverly plant consists of a control valve, operated by an air signal, which controls the flow of alum from the storage tank. The control receives its signal from the Integral Orifice d/p Cell transmitter. An alum flow recorder registers daily flow. Liquid alum is discharged to the injector and pre-diluted prior to injection into the plant influent raw water line. The injector and injector lines are the main items which require periodic cleaning.

■ ELECTROLYSIS AS IT APPLIES TO THE WATER WORKS SUPERINTENDENT by Francis N. O'Hara, Supt., Public Works, Arlington, Mass.

A superintendent should have some understanding of electrolysis and corrosion control in order to evaluate breaks and leaks in water works facilities. He should be able to determine if leaks or breaks were caused by electrolytic action and then be able to determine what type of corrosion occurred so that corrective measures can be applied to prevent re-occurrences.

Iron pipe is a good underground conductor of electrical current. Impressed current, the first example of one form of corrosion, caused a num-

ber of leaks in the city of Boston. At those points where underground power lines were brought to the surface to be carried by overhead transmission lines, the electrical charge from impressed current on water mains jumped from the main to the power line at this point. This caused pitting which developed into 1 to 3 inch holes in the iron pipe.

The galvanic cell is another example of corrosion. Brass fittings and shut-offs on iron pipe will eventually cause the corrosion of the iron in what is known as the two metal corrosion cell.

Concentration cells are the cause of corroded water pipe which has been laid in ash dumps or near areas affected by salt water intrusion. Here the soil acts as the cathode and the pipe as the sacrificial anode.

Differential aeration is the cause of corrosion in rivets of steel tanks, and in pipe wherein some of the pipe is covered and some isn't. That area exposed to the higher concentration of oxygen acts as the cathode while the area with the less concentration of oxygen is the anode.

Corrosion in meters is a major problem to water works superintendents. Meter companies are aware of the problems associated with dissimilar metal corrosion (the Galvanic cell).

All corrosion cells are affected by pH and velocity of the solution in contact with the metal. It must be remembered that corrosion can not occur without moisture. Higher velocities increase rate of corrosion as will lower pH. An increase in temperature usually supports increased rate of corrosion.

■ LAKE WHITNEY SANITARY CONDITIONS IN RELATION TO CERTAIN LABORATORY EXAMINATIONS by Samuel Jacobson, Dir. of Lab., New Haven Water Co. and Everett L. MacLeman, Assoc. Prof., Sch. of Eng., Yale Univ., New Haven, Conn.

The New Haven Water Co. required some type of indicator for determining the sanitary condition of the water supply and for pin-pointing problem areas within the Lake Whitney water shed.

Extensive suburban development within the watershed of the Mill River tributary, pine swamp, and Lake Whitney itself has created many new pollution sources. Many of the developments have been constructed on recently released water company land and are located within 100 ft of impounded waters. Only that area near Lake Whitney is served by a sewerage system and the majority of the new developments resort to underground disposal methods.

Laboratory studies on samples obtained from various stations throughout the watershed supported a finding that algae growth in summer was associated with pollution. The studies from July 1955 to June 1956 showed that MPN of coliform organisms not necessarily of sewage origin, changes in nitrate concentrations, and algae blooms proved sufficient evidence to pinpoint sources of pollution and foretell of impending difficulties affecting the sanitary quality of the impounded waters.

Surveillance of water quality to preclude other than chlorination prior to distribution offsets a considerable costly outlay in complete treatment facilities.

■ OCCURRENCE OF WATER IN BURIED-VALLEY DEPOSITS by David W. Miller, Geraghty, Miller and Hickok, Consulting Ground-Water Geologists, New York, N. Y.

The ground water resources of Northern U. S. are not fully appreciated. This may be due to the fact that they are more difficult to evaluate fully than are surface resources.

Northern U. S. was formed by glacial ice and running waters. When the ice cover receded, the till and outlying drift, carried by the ice, was deposited on the bed rock. The running waters of the melting ice deposited large volume of sand and gravel which formed buried valleys. These valleys, surrounded by bed rock hills, may be 300 ft or more in depth, and extend for many miles. They are prolific acquifers and wells located in buried valley deposits have reported pumping capacities of more than 4,000 gpm.

The problems associated with buried-valley deposits, after first locating and determining their size, may be one of over pumpage from other wells in the acquifer or overlying clay soils which prevent the recharge of the acquifer. Artificial recharge from melting snow or other surface supplies may be necessary. The safe yield of valleys and other economic considerations should be determined by qualified persons experienced in ground water geology.

■ NEW DEVELOPMENTS IN POWER OPERATION OF WATER VALVES by Payne Dean, Payne Dean & Co., Clinton, Conn.

The valve is an emergency device, but few valves are operated and properly maintained in operating condition. Calculations show that four men using a key must each walk two miles in order to close a 48 inch gate valve, 1.5 miles to close a 36 inch, and 1.25 miles for a 30 inch.

The first power operation of a valve using a truck mounted unit was accomplished in 1927. Since then, some 300 cities have been equipped with power operated valves. Some water works personnel fear that power equipment will break the old valves in their systems and say, they are satisfied to use available manpower to break any valves that need broken. This is not true because in many cases, power equipment is the only item which can operate old valves.

New hydraulic motors replace the bulky gasoline or electrical power sources and provide equivalent horsepower. The ½ inch transfer line capable of transmitting 2,000 lb of usable pressure allows a hydraulic unit to develop some 400 ft-lb of torque which would easily operate a 30-inch gate valve.

■ HOW SUPERVISORY CONTROL CAN HELP NEW ENGLAND WATER SYSTEMS by Bambi L. Socia, Application Engineer, Builders-Providence, Inc., R. I.

"Supervisory Control is a system for remotely controlling the operation of any combination of pumps, valves, gates, generators, circuit breakers and similar devices. Two function supervisory control is the simplest system while the 'building block' construction of 'plug-in' components permits multi-function operation to meet the most complex installation."

Two function supervisory control can be used for simultaneously telemetering any two of these functions pressure, flow, level, temperature, gate or valve position, flow direction, pump start-stop, valve open-close, single pumps start-slip with "report-back," and valve control jogging of valve position in either direction.

In the multi-function system, as provided in the Synco-Scan supervisory control system, any number of functions up to 29 can be controlled or reported on. From this system results many advantages: Centralized control, reduced operating costs, increased system capacity, increased dependability and safety, elimination of distance factor and system expansion at low cost. Intermittent scanning is used in the multi-function system and only one pair of signal wires, either leased or private is required for the whole system. Other methods of signal transmission include modulated carrier frequency (over telephone lines), audio-tone channels (over telephone lines) and microwave link (radio transmission).

NEWWA Resolution on Recreational Use of Public Water Supplies

At the annual meeting of NEWWA, held in Poland Spring, Me., the Committee on Conservation, Development and Utilization of Water Resources, presented a final report in which the following recommendations were included:

State Laws and Regulation regarding the control of water supplies—The Committee recommends that all laws and regulations regarding the control of public water supplies should be specific directives and should avoid discretionary clauses.

Proposals for Relaxation of Restriction—Proposals for any relaxation of the sanitary controls of a water supply should be submitted:

First, to the State Health Agency for a review of the sanitary implications.

Secondly, only when the report of the State Health Agency is favorable, it should be reviewed by the water utility manager who should have the authority to attach such limitations to the proposal as he considers necessary to prevent interference with his moral and financial obligation to produce a safe, palatable water supply.

Thirdly, it finally should be subject to review by the consumers at a public hearing or by referendum.

Policy on Recreational Use of Water Supplies: Reservoirs may be classified as follows:

Equalizing Reservoirs—Reservoirs, within the area served, delivering finished water (water ready for consumption) to the distribution system.

Policy—Recreational use of "equalizing reservoirs" and adjacent marginal land is inimical to the basic function of furnishing a safe and palatable water supply to the system's customers, and safe practice requires prohibition of all recreational activity in and about such storage reservoirs.

Terminal Reservoirs—Areas providing end storage of water prior to treatment and to delivery to the distribution system.

Policy—In general, recreational use of terminal reservoirs is inimical to the basic function of furnishing a safe and palatable water supply to the system's customers, and should be prohibited.

Upstream Reservoirs — Reservoirs providing storage of raw water at various points in the watershed to provide or supplement the supply at the terminal.

Policy — Recreational use of *upstream reservoirs* should be subject to the control of the sanitary regulations of the State Health Agencies concerned and to such limitations as the water utility management considers necessary for preventing interference with his obligations to produce a safe, palatable domestic water supply.

Following the presentation of the report, the committees presented a resolution concerning the recreational use of public water supplies. This resolution was passed by the NEWWA meeting. It reads:

"Whereas: Man is a carrier of disease, and there are reservoirs of infection still prevalent, and interstate and international travel is heavy, and man's natural immunity is constantly lessened by his excellent sanitary environment and by the continued use of antibiotics, and

"Whereas: Water is still a potential disease transmission medium, and the results of laboratory testing are so delayed as to allow infection of a community not protected by proper sanitary controls of its water supply, and treatment facilities and processes are not completely infallible, and there have been recent experiences of gross pollution of supplies where recreation was allowed.

Now, Therefore Be It Resolved: That the New England Water Works Association opposes legislation and administrative action that will permit or require the opening of domestic water supply reservoirs and adjacent lands to recreational use.

And Be It Further Resolved: That the New England Water Works Association registers its approval of the policy to maintain the control of domestic water supply reservoirs in the hands of the State Health Agencies and of the Water Purveyors and of the Consumers."

The terminology used in these policies regarding recreational use of public water supplies is the same as that used in the AWWA policy adopted last spring.

NEWWA Officers for 1958-59

Officers elected to serve NEWWA until the annual meeting in 1959 are:

President: Clarence L. Ahlgren, Asst. Supt., Manchester Water Works, Manchester, N. H.

Vice President: Warren A. Gentner, Deputy Mgr. & Chief Engr., Water Bureau, Met. District, Hartford, Conn.

Vice President: Kenneth W. Robie, Supt., Water Dept., Brookline, Mass.

Directors: Peter C. Karalekas, Springfield, Mass.; Walter J. Shea, Providence, R. I. and Kenneth W. Knowlton, Beverly, Mass.

How to use large quantities of salt economically in . . .

Regeneration of Ion-exchange Softeners

by PAUL C. ZIEMKE
Clinton, Tenn.

RESUME: When large quantities of salt are handled for ion-exchange water softener regeneration and brine making, both hand labor and expense may be avoided by installing a large, rugged facility for storage and dissolving the salt.

■ A STORAGE TANK should be arranged to receive dump truck lots through a cast iron manhole set in the concrete of the pavement, either inside or outside the plant. In some plants the hopper idea is used as the receiving point with distribution to elevated storage by endless chain conveyors, or rubber belt line. A brine storage tank may be on the same level as the receiving hopper or at some remote and elevated point where the pipe lines are extended to it. Brine is then either pumped to, or gravity fed to the process.

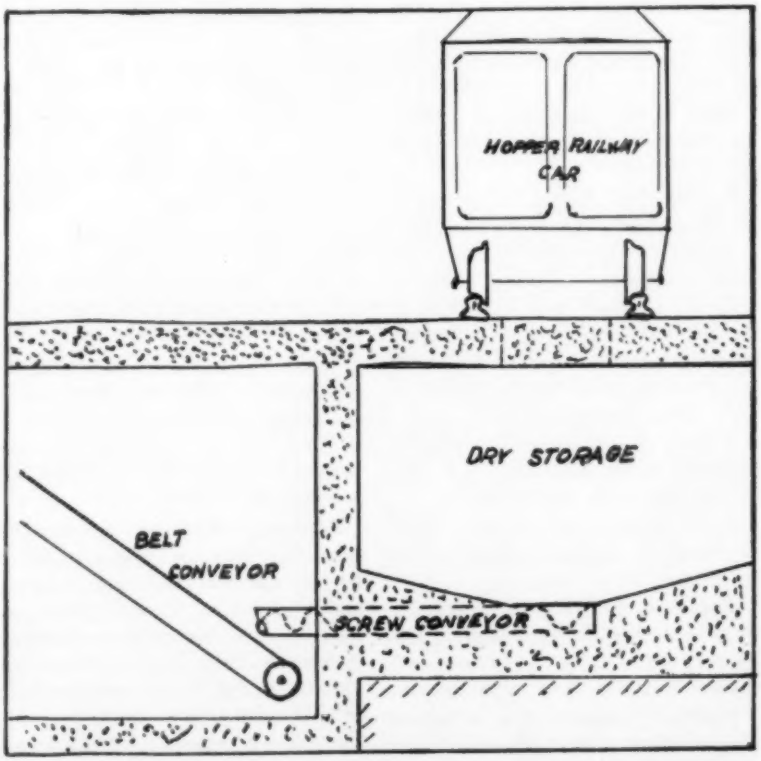
If desired, the receiving hopper can be used for a dual purpose, that of initial storage for the dry salt, and the brine that is developed as water is added. A phenomena about brine is that though the tank appears to be full still additional amounts of salt can be introduced into the seemingly fully saturated brine. The brine may then be pumped to any point in the plant with centrifugal pumps designed to handle slurry.

Undertrack Storage

One mid-western municipality having a water softening plant of considerable size in connection with its 1840 ft artesian supply has installed undertrack storage arranged beneath the spur laid by the railroad to receive hopper-bottom car shipments of salt. The accompanying sketch indicates an arrangement of this nature.

The high first cost of this installation was more than offset in the simplicity of the system that gets the salt unloaded and coverted to brine for the ion-exchange regeneration process.

Another plant using hopper-car-lots of salt has a dual-compartment storage arrangement where two separate dissolving compartments store an ample supply for daily requirements. The control room is located adjacent to the storage and dissolving chambers. Extra storage capacity is ample to tide over any delays that may occur in rail shipments. Purchases of bulk lots reduce the unit cost of material.



SALT in bulk quantities can be stored in concrete bins loaded from hopper-bottomed railroad cars and conveyed to solution tank by screw and belt conveyor system.

REPORT FROM ABROAD

From England comes a progress report of the standing technical committee on . . .

Synthetic Detergents

by JOHN FINCH, Manager
Sewage Disposal Department
Slough, England

AUTHOR'S NOTE: The "Progress Report of the Standing Technical Committee on Synthetic Detergents," published in February, 1958 reviews the position in the field, covers trouble attributed to the use of detergents, comments on the trends in consumption of synthetic detergents and details the research program being pursued in Great Britain under the aegis of the committee and the remedies available for suppressing foam at the source of production.

In effect, the report consolidates the position in respect to analytical procedure, and also the validity of certain complaints related to foaming, in addition to which it gives some idea as to the dimension and scope of the research program now getting into its stride in various parts of the country. There is also mention of a welcome tie-up with the Task Group of the AWWA on the common problems associated with the use of synthetic detergents.

■ THE COMMITTEE checked and agreed upon analytical procedure, and then circularised 104 sewage treatment authorities, all the river boards and all the water works taking water from rivers for public supply.

Questionnaires

The questionnaires to sewage works and water plant asked for brief particulars of capacity and type of plant, details of routine sampling, together with analysis and information regarding any synthetic detergent determinations that might be made. River boards were asked for particulars of any samples taken for analysis which included synthetic detergent determinations.

Pending a detailed examination of the replies, a brief scrutiny suggests that records adequate for their purpose are already being compiled by a sufficient number of authorities.

The committee reports that undoubtedly the most spectacular effect is still that of foam occurring on certain rivers, canals and sewage works. The Docks and Inland Waterways Commission have stated that on occasion persistent foam at particular places on navigable rivers and canals is so extensive and deep as to reduce very materially the chances of rescuing anyone falling into the water. At such places anti-foaming agents are a necessary concomitant of lifebelts, but recent trials by the Commission suggest their value is limited.

There has also been a complaint from a town where foam, formed when the river passes over a weir, blows along the streets. On a smaller scale foam has been experienced arising from sink gullies in blocks of flats. This matter has been reported recently by various Metropolitan Borough Councils at the request of the Metropolitan Boroughs Joint Standing Committee. One authority has expressed the opinion that the increase of the foam depends upon the design and layout of the drainage system.

Effect on Effluents

An inquiry has been received asking if the committee members are concerning themselves with the possible effects on effluents, and consequently on rivers, of the anti-foaming agents in use at sewage works. The committee is taking cognisance, not only of the effect of these materials, but also of the additives present in the detergent powders as retailed.

The Jephcott Report included a table showing the annual consumption of surface active agents—on which synthetic detergents are based—in the United Kingdom between 1949 and 1954, and this is now brought up to date, including the earlier figures for comparison:

United Kingdom Consumption of Surface—Active Material in Thousands of Tons

	Domestic	Industrial	Total
1949	10.5	2.5	13.0
1950	12.5	2.7	15.2
1951	14.0	3.8	17.8
1952	21.0	5.2	26.2
1953	29.0	6.0	35.0
1954	33.0	6.0	39.0
1955	34.0	6.5	40.5
1956	34.5	6.5	41.0

Increased Consumption

These figures show that the extraordinarily rapid increase in the consumption of these materials between 1949 and 1954 has now given place to a much slower rate of progress. From these figures it would appear that the home market has almost reached the limit of consumption under present conditions, and that, unless there is a radical, and at present unforeseen, change neither the domestic nor the industrial consumption is likely to expand much further. It is, therefore, not unreasonable to infer that, unless the composition of the products marketed undergoes a substantial alteration, existing conditions are not likely to change significantly.

The Department of the Government Chemist is pursuing several lines of investigation on analytical methods, and at least one industrial firm has been testing the various published analytical methods. The Water Pollution Research Laboratory is carrying out experiments on the toxicity of detergents to fish and how this is modified by sewage treatment processes, and also on the effect of detergents on the rates of re-aeration of sewage and river water. The Civil Engineering Department of Durham University has initiated a programme of research into the effect of sugar-based detergents on biological purification processes at sewage works.

So far as sewage works are concerned there are two specific remedies available for suppressing foam, and both are in use. One is to add chemical anti-foaming agents, and the other is to break the foam down mechanically by spraying with water. It has also been found that if the activated sludge process is so operated as to effect a substantial measure of nitrification, foaming in the aeration tanks does not reach objectionable proportions. All these remedies, though useful in certain circumstances, are local and their effect is transitory; they do not affect to any marked degree the concentration of surface-active agent in the effluent discharged, and may, therefore, be regarded as palliatives rather than cures.

Anti-Foamants

The use of chemical anti-foamants on rivers has been proposed, but their direct addition to river water would, presumably, require the consent of the local river board or river purification board, who would, no doubt, require proof of their innocuity. The local authority who complained of foam in their streets are contemplating the use of water sprays to control the foam at the point of origin.

The Metropolitan Water Board, in whose laboratories valuable research work has been carried out on the relation between the chemical structure of detergents and their amenability to the attack of biological organisms, have offered to test, on a laboratory scale, the biological decomposability of any compound which a manufacturer has under consideration as a marketable material. The Department of Scientific and Industrial Research has agreed to the Water Pollution Research Laboratory carrying out pilot scale tests for the same purpose.

New Detergent

The difficulty appears to be to formulate a detergent which can be made from a raw material available in the requisite quantity and at a cost, if not as low as those at present in use, at least of the same order. It is also economically desirable to use the bulk of the existing manufacturing plant, on which large capital sums have been expended. Furthermore, the final retail product must be as acceptable to the housewife as those she can now buy. The importance of export sales must not be overlooked in this connection.

There is at least one point made by the committee about which it is stated that there is some measure of disagreement. This is in respect of the effects of detergents on sedimentation of sewage, and the committee consider that this problem might very usefully be investigated.

Sewage and Waterworks Construction—1957

Contract awards in the sewage and waterworks fields totaled over one billion dollars in 1957, according to a Public Health Service Publication, "Sewage and Water Works Construction—1957." In 1957, sewage treatment awards were $351 million, only slightly less than in 1956 which included one $78 million project. There were 1150 contracts awarded in the sewage treatment field. This is an increase of 79% over 1956.

This is the first year that the Public Health Service has compiled data for collecting sewers and for waterworks. Awards for waterworks include detail by type: source, treatment, and distribution. Waterworks awards totaled slightly more than $450 million, and collecting sewers were almost $250 million.

The contract award data are reported in three main areas: sewage treatment works, collecting sewers, and waterworks, and are presented in tables arranged by population size groups, contract size groups, 15 major drainage basins of the United States, and by States.

"Sewage and Water Works Construction—1957" is issued as PHS Publication No. 608, a copy of which may be obtained on request from the Water Supply and Water Pollution Control Program, Public Health Serv-Control Program, USPHS.

At Last the Guesswork is Removed from Deep Well and Sewer Maintenance Through the Use of . . .

Underground Photographic Surveys

by CHARLES H. SORTOR, Manager, Laval Underground Surveys, Fresno, California

EDITOR'S NOTE: This article explains the methods for seeing what is underground through the use of photographs. The photographic equipment, the limitations and the applications for its use in sewer and deep well surveys are described.

The prime function of this service is to provide that advantage of knowing the exact location and status of breaks or failures, or the overall condition of pipe which is buried underground. Such information is indispensable to preventative maintenance programs.

■ FOR YEARS the biggest problem in the repair and maintenance of deep wells and sewer lines has been the exact location and nature of the failure. Often entire sewer lines had to be excavated in order to repair a very localized failure. The situation with regard for deep well failure was even more critical. No excavation was possible; therefore, all repair work had to be by guesswork. These troublesome problems no longer exist, however, due to the ingenuity of Mr. Claude C. Laval, Jr., who has developed a stereo camera for photographing, in place, deep wells and sewer lines. This development is a significant one in the field of underground surveying.

FIG. 1—CAMERA ready for lowering into well.

History

There are more than 50,000 water wells in the San Joaquin Valley of California, varying in depth from less than 100 feet to more than 3,000 feet. They penetrate the deep alluvia of the valley floor and produce more than 9,000,000 acre feet of water each year for irrigation, industrial and domestic use.

Relatively little trouble has been experienced with the shallow wells. Many of these wells have lasted as long as forty years, and their average life expectancy could probably be set at thirty years. But the record of the deep wells has not been as good. Average life has been ten years or less. Some of them have developed casing breaks during the first month of use. In some areas the life expectancy has been as low as five years.

In 1945 and 1946 Peerless Pump Division in Fresno, California, undertook a study of the problem of well failures. Throughout the study it seemed that the greatest difficulty lay in the fact that actual field conditions could not be duplicated in the laboratory and there was no way to see what went on in a well.

In 1947 the problem was taken to a man named Claude C. Laval, Jr., with a request for a camera which might be lowered into wells to photograph their interiors.

He went to work at once and soon had a camera which worked fairly well. After a year or so of perfecting, he was able to get good pictures which could be viewed in three dimensions and had applied for patents on the basic feature which made well photography possible, see Figure 1. His pictures soon showed the causes for deep well failures and made repairing a simple matter.

Well Photography

There are three common types of well failures, all of which show up very well with the Laval camera. These are: (1) axial compression failures, (2) parted casing failures, and (3) casing collapse failure.

Axial compression failures usually follow the same pattern. Tiny peripheral wrinkles first appear. Some portions of the wrinkles grow more than others and generally from three to six progress to the point of rupture. Some of the ruptured portions of the casing are intruded into the well and some extruded. The total length of the deformed section is usually from one to four feet. The casing may break at one elevation on one side and at a different elevation on the other. This usually causes a "dog leg" and the axis of the section of casing between the two breaks becomes misaligned with the axis of the well. Working "blind" in this type break with old fashioned percussion swages, the well repairman usually broke through the casing wall and ended up with a big repair bill and a ruined well. When the exact nature of the break is known, however, repair is usually easy, see Fig. 2.

Photographs sometimes show casings parted at the welds. When this is the case, the zone of break is usually carefully photographed with a side wall camera to show the nature of the break and the length of separation between the two sections of casing. With this information, it is a simple job to place a liner over the break.

When the failure is due to casing collapse, the camera shows the degree of ovaling and whether or not the casing has ruptured as a result of the collapse. Frequently, the collapsed casing can be straightened out and returned to its original roundness. Working without photo information makes this simple repair job nearly impossible.

FIG. 3—SWAGE being swung into position for repairing 18" water well.

Casing Repair Tool

For repairing all types of casing breaks and distortion, a companion tool to the Laval well camera is the Laval electro-hydraulic swage, Fig. 3. This patented tool can be run on pipe or wire line and can quickly and safely straighten out compression wrinkles, breaks and ovals. Torn sections of casing can be pushed back into place so that liners can be driven tightly into position. It can be preset to give a definite diameter, so that the repairman may expand the damaged section beyond its normal diameter or he can leave any desired amount of "spring back" to hold the liner in place. The swage can also be used to "crimp" liners in place or to bell out to shut off sand and water which might leak past the upper or lower end.

Supplementary Uses of Well Photography

One use of photo logs that is becoming more popular is as a part of the well acceptance test. This is advantageous to the driller as well as to the client since it provides positive proof of the use of proper materials and workmanship and releases the driller from responsibility. Another use is the detection of minor well defects such as plugging of perforation slots

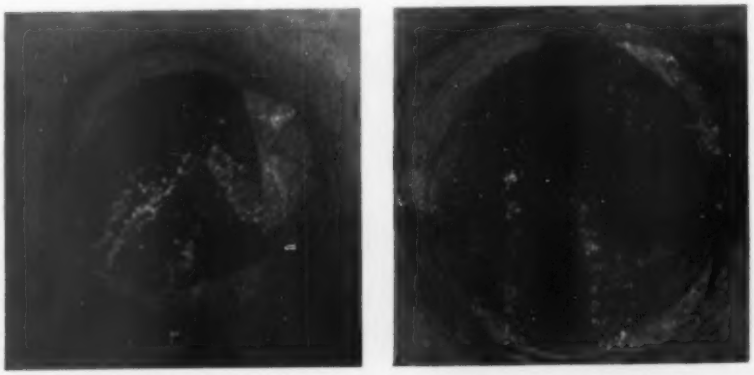


FIG. 2—BEFORE: This compression break in a 16" x ¼" casing is above the static water level. But water from a shallow aquifer is running into the well and falling 100 feet to the water level, trapping and entraining air and lowering pump capacity.

AFTER: Here's a photo of the same casing shown above after a Laval swaging job, ready to receive a press fit liner. Result: Water was shut off and well went back on pump, good as ever.

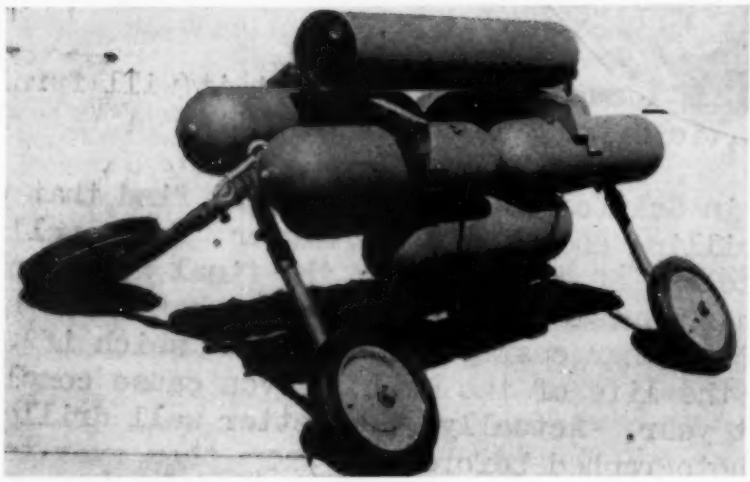


FIG. 4—TROUBLE SHOOTER camera and carriage can be used in six inch and larger diameter horizontal and inclined sewerage and pipe lines.

by calcium deposits or the growth of barnacles over the perforations. Any of these minor troubles can be more easily and quickly treated if the exact nature of the trouble is known. A final use of well photography is in connection with a preventative maintenance program. As well pumps are removed for repair, the wells are photographed from top to bottom and the photo logs are placed on file for comparison. Any defect can thereby be noticed as it develops, and repairs can be made before the trouble is serious. This results in long well life and less down time for major repairs.

Sewer Photography

The application of this technique to sewer maintenance is a valuable one. In this case the camera is mounted horizontally, usually on wheels, Fig. 4. The camera is operated electrically through a trailing cable, and the six air tanks keep the equipment from falling in any hole or getting stuck on an obstruction. When lines smaller than six inches are to be surveyed, the camera is removed from the wheels and placed on a sled. The camera on sled or wheels, is placed in the sewer at a manhole and pulled up to the next manhole by a cable connected to a winch. If necessary, the camera contains enough film to photograph ⅜ of a mile when taking pictures every five feet. The camera can travel 10 to 20 feet per minute and can take pictures every 15 seconds. As with the well camera, the pictures are stereo photographs.

Uses of Sewer Photography

The advantages for this type of operation are many; one of the most important being that no man need risk his life or expose himself to the possibility of bodily harm in making sewer inspections. Another advantage is the accurate detection of any structural failure. Not only is the defect exactly located, but its nature is clearly revealed. This greatly aids repair work by peventing much unnecessary digging. Small lines could under no circumstances be inspected by a person; expensive digging would be the only positive alternative to photography. One disadvantage of this method is that unless the sewer line can be dewatered by bypassing the flow, only the portion of the sewer above the sewage level can be viewed.

Three of the common defects other than collapse which can be easily detected by this type of underground survey is the infiltration of ground water, when the ground water table is above the sewer pipe, the intrusion of roots and the accumulation of grease. Fig. 5 shows cases of the latter two problems in an 18" sewer line. When ground water is flowing into a sewer, it is almost impossible to determine the point of inflow except by viewing the line from the inside.

Sewer photography, as in the case of well surveys, can be used an as effective preventative maintenance program as well as being used for final acceptance inspections of new sewer lines.

Summary

The use of photography for underground surveys in the field of well and sewer line maintenance by the Laval Underground Surveys Company has saved millions of dollars by taking the guesswork out of repair. With the Laval camera, the problem can be exactly located, and its cause accurately identified. Once this is done, a potentially large job becomes a small repair operation.

FIG. 5—GREASE in foreground encrusted in 18" sewer. Note roots growing through defective joint. White card in background being held through manhole is a convenient method of recording date and section of sewer.

The Practice, Hazard, Acceptability, Value, and Experience in the Use of . . .

Sewage Sludge as Soil Conditioner

by The EDITORS of *Organic Gardening and Farming Magazine*, Emmaus, Penna.

EDITOR'S NOTE: This article has been made available for publication in this issue with the permission of Jerome Olds, Managing Editor, ORGANIC GARDENING AND FARMING MAGAZINE. The material presented was obtained from available research data on the subject and from questionnaires circulated to state, sanitary engineers and plant superintendents throughout the United States.

The response of 32 cities and 36 states are represented in tabular form. An upward trend exists in the demand for all forms of sewage sludge for use as a fertilizer or soil conditioner.

■ SALES OF sewage sludge to gardeners and farmers throughout the United States have increased in recent years. In cities such as Boise, Chicago, Wichita, Grand Rapids, Duluth, Omaha, Santa Fe, Schenectady, Houston, Roanoke and Milwaukee, superintendents of sewage treatment plants report that demand for sludge has been increasing.

F. C. Funnell, Jr., head of the Roanoke, Virginia sewage plant reports that his "customers use ground sludge at $2.00 per cubic yard on lawns. Unground sludge, at $1.50 per cubic yard, is used mostly in the gardens. Sales run about two-thirds of ground sludge to one-third of the unground. This is all in bulk sales since we do no bagging. Our experience with the material shows spectacular results on both lawns and gardens over and above the results expected from the nitrogen-phosphorus-potash analysis of the sludge."

Some of the larger cities market their sludge through fertilizer distributors. For example, H. J. Baker Brothers of New York sells both Houston and Chicago sludge. Others (most well known is Milwaukee) have set up their own marketing and advertising departments.

Spraying Groves

Florida Sanitary Engineer, Ralph Baker, Jr., describes how "several of our cities, namely Orlando, contract with local fruit growers for the use of liquid digested sludge which is pumped into tank trucks and then is sprayed upon the local citrus groves. Contract prices are usually in the range of $3.30 per thousand gallons."

The great majority of cities do not sell their sludge, but make it available to local gardeners and farmers free at the plant site. In Illinois, for example, according to Sanitary Engineer Carl Gross, "virtually every city and sanitary district which operates a sewage treatment works makes the digested and air-dried sludge available at the treatment works to anyone. In a few instances, there is a nominal charge but in general, the sludge is available at no cost."

Since 1948, Richmond, Indiana has been hauling liquid sludge for the benefit of neighboring farms. William Ross, superintendent of the plant, estimates that over 4 million gallons were hauled last year alone. A similar practice is carried on at Marion, Indiana, where usage has tripled since 1952.

For Beautiful Parks

"The City of Las Vegas has never placed on market the sludge from its sewage disposal plant. It has been the policy of the City to use the sludge for development of parks, recreational areas and cemetery facilities over the last few years," according to V. B. Uehling, Public Works Engineer. "The demand for sludge for these purposes by the Park Department has exceeded the actual supply. We've found that the sludge has been a very useful product in adding humus to the desert soils found in this area and in building the turfs within the park developments."

In Stratford, Connecticut, the sludge is shredded for park use and is also spread and mixed with sand for a fill over the refuse dump. "When mixed with sand, it makes a good binder holding the sand from blowing away and helps support the growth of rye used for a cover until the ground will support a good grass," explains the Stratford plant superintendent.

In Oshkosh, Wisconsin, sludge helped out the city's children. "We had a stock pile of sludge last year," R. Frazier, superintendent of the plant, told us, "and the park superintendent wanted to recondition his soft ball diamonds. In working out a plan, the sludge was ground and mixed with sand and clay and placed on the diamond. The results were surprisingly good. The diamond was more easily maintained, more life to the ground, dried out easier after the rains, etc."

The Right Approach

LeRoy Van Kleeck, Principal Sanitary Engineer of Connecticut's Department of Health, has done much research regarding the use of sludge as a soil conditioner and "has advocated the use of sludge for the above purpose for some years. His excellent report, "Digested Sewage Sludge as a Soil Conditioner and Fertilizer," contains illustrations of his property where sludge was used for a number of years with very gratifying results. Engineer Van Kleeck estimates that

at least 50 per cent of the sludge output from some 55 municipal sewage treatment plants in Connecticut is finding its way back to the soil.

"The use of sewage sludge we have found in Connecticut to be largely dependent upon a proper interest and approach on the part of the sewage plant superintendent. If he promotes its use and explains to people its limitations, it is favorably received by the public. In a few towns where no publicity is given to the material it is simply used as fill."

Schenectady Case History

Experiences at Schenectady, New York point up the validity of Mr. Van Kleeck's observation. "We have no special way of promoting our sludge soil conditioner, other than taking advantage of every opportunity to tell the public about its organic content and its ability to improve most every soil. It is my firm belief that we who are in charge of a sewage treatment plant are in duty bound to see that these organics are returned to the soil." Those are the words of Clifford E. Irving, superintendent of the Schenectady plant. Following is a history of his plant's experiences in marketing sludge:

"It was not until about 1924 when the first successful attempt was made to sell air dried sludge to the public. At that time, Morris M. Cohn then superintendent of the Schenectady plant, offered this material for sale at the astounding price of ten cents per load. This followed an unsuccessful attempt to give it away. By establishing a price for this product, the public was made to realize that it had some value. The farmers came with their trucks and loaded them until the springs were oxer-taxed. The customer wanted his money's worth and indeed he got it.

"Through the years, the price advanced to 25 cents per cubic yard. Some attempt was made to grind the sludge and offer it for sale at 25 cents per bag, the customer bringing his own container. With all of this promotion, a warning had to be issued with each sale, of the possibility of some pathogenic bacteria being carried over in the sludge. This naturally limited its use to those crops which went to the table cooked.

"By 1948 when plans and specifications were being drawn for the modernization of the Schenectady plant, we realized that we had a good market for organic soil conditioner and that we should do everything possible to take advantage of it. We, therefore, had designed into our specifications the now existing facilities, namely vacuum filters, flash drying, incineration, fly ash and odor control, and sludge bagging.

"The new plant was started in January of 1953, but it was not until January 1954 that there was sufficient sludge available to start processing. During this time we were actively engaged in a sales promotion campaign. We talked Orgro (the trade name which we adopted for our organic soil conditioner) to everyone with whom we had contact. We took advantage of all free newspaper, magazine, radio or television advertising we could get. We spoke to farm groups, garden clubs, parent-teacher groups, etc. We never allowed an opportunity to pass without plugging our product. We ran experiments to prove Orgro's value to our own employees for they are our best salesmen. Next we packaged Orgro in neat, easy-to-handle 65-pound three-ply paper bags.

"When we opened the door for sales in April of 1954, the entire inventory was completely sold in two days. We then limited customers to two bags per sale until September when we were able to meet the demand. Since that time our sales and production have increased each year.

"The following chart will present a cost picture of a typical day's operation at Schenectady.

	Dry	*Burn*
Labor	24.50	15.75
Fuel	31.38	13.44
Power	10.44	10.88
Bags	12.00	0.00
Tot. Costs	78.32	40.07
Revenue	100.00	0.00
	+21.68	—40.07

"It is obvious from this chart that there is over a $60 saving to the city every day we operate."

The Schenectady sludge has an NPK analysis of 2-2-½; annual output is 250 tons with less than 5 per cent moisture content, and is priced at $1.00 for a 65-pound bag.

Largest Commercial Set-up

Milwaukee and adjoining suburbs have an up-to-date sewage purification plant—the first one to use the activated sludge method on a large scale and to produce a high-grade fertilizer as a by-product. Its activated sewage treatment method removes 98 per cent of the bacteria and 95 per cent of the solids in sewage. The sludge product, Milorganite, is guaranteed to contain 6 per cent nitrogen and 3 per cent phosphoric acid plus many trace elements needed for plant growth. Almost a million tons have been produced and sold since production started in 1926. According to the Milwaukee Sewage Commission, the annual revenue from the sale of Milorganite exceeds $1,350,000 and covers about half the cost of operation.

Topsoil Building in New York City

For several years, New York City has been spreading sludge over some of its municipal park areas as part of a "topsoil building" project. Mr. Edward Brady, Director of Special Projects of the New York City Park Department, developed an entirely new method of applying the sludge. Here's how it is done:

Tankers carrying the sludge deliver it at a pumping station on the bay (Jamaica Bay), where it is pumped through two 12-inch cast iron pipes to the park site. After the land is graded with earth-moving machines, a network of six-inch aluminum piping, purchased from an irrigation equipment company, is laid over the area to be treated.

At regular intervals along this piping, portable fire engine deckpipe nozzles mounted on dollies are set into the pipes. Thus the liquid sludge, relayed by gasoline centrifugal pumps, can be evenly distributed over large areas at a time, each nozzle sweeping back and forth under the control of a single man.

About a gallon of the sludge per square foot is applied at each spraying. It is allowed to dry about three days, depending on the weather, then disked in. Every section of ground is sprayed and disked 16 times, until approximately four inches of sludge has been applied. The diskings mix this in seven to nine inches. The results has been a rich, dark topsoil perfect for park lawns, golf course and other recreational facilities.

Cost-wise, Mr. Brady analyzes it

Table 1

Prices of Sewage Sludge

City	Brand Name if any	Annual Output	Nitrogen	Phosphorus	Years Sold	Sales Trend	Price
Birmingham, Ala.	.....	48,000 cu yds	2.25	3.0	24	No change	$1.50 per cu yd rough grade, $3.50 per cu yd ground
Phoenix, Ariz.	Air Dried, Digested	About 5000 tons	(no recent analysis)		25	No change	$3.12 per ton air dried
San Diego, Calif.	Nitro Gano	3,500 tons	2.75	4.54	1943-1955	Down	$6.00 per ton contract price, —$2.80 per 100 lb, bagged
Bristol, Conn.	Sludge Soil Conditioner	600 cu yds	2.69	2.52	5	Up	$.25 per bushel, pulverized; $1.60 per yd, sludge cake
Boise, Idaho	B.I. Organic	200-350 tons	3.59	.....	5	Up	$3.15 per 80 lbs, retail bagged
Chicago, Ill.	Dried activated sludge	125,618 tons	.....	.....	17	No change	All sludge shipped in bulk—no bagging
Fort Wayne, Ind.	.....	3,000 tons	2.5	2.5	18	Upward	.....
Indianapolis, Ind.	Indus	50 tons per day	5	2.7	Less than a year	.....	$22 per ton
Richmond, Ind.	.....	4.06 mil gal of Liquid Sl.	(No analysis made)		9	Up	.....
Mishawaka, Ind.	.....	152 tons	2.66	1.12	4	Up	.....
Jasper, Ind.	.....	50 tons	5.89	3.49	8	Up	.....
Marion, Ind.	.....	921 tons	1.49	1.45	16	Up	.....
Wichita, Kan.	Wichita Soil Conditioner	5,000 cu yds	2.1	.2	8	Up	$2.00 per cu yd loaded at plant, $3.00 per cu yd delivered in city, $4.00 per cu yd delivered 10 mi beyond
Battle Creek, Mich.	Battle Creek Plant Food	200 tons	2.8	2.6	13	No change	$2.00 per 100 lb, bagged
Grand Rapids, Mich.	Rapidgro	600 tons	2	2	25	Up	$1.00 per 80 lb, bagged
Duluth, Minn.	Soil Conditioner Sewage sludge fertilizer	44 tons	1.0	1.5	15	Up	$1.00 per 100 lb, bagged

this way: "It costs the Department of Public Works approximately $560 a tanker load (250,000 gallons) to transport and dump sludge at sea. Three loads a week used to be carried away from the treatment plant that now supplies the topsoil project. So the city is saving over $1,600 a week —and at the same time producing the most vital substance on earth from a material formerly a complete loss."

Activated or Digested?

The fertilizer value of the sludge produced depends largely on which processing method is used.

1. Activated sludge: This kind is produced when the sewage is agitated by air rapidly bubbling through it. Certain types of very active bacteria coagulate the organic matter, which settles out, leaving a clear liquid that can be discharged into streams and rivers with a minimum amount of pollution.

Generally, activated sludge is heat-treated before being made available to gardeners and farmers; its nitrogen content is between 5 and 6 per cent, phosphorus from 3 to 6 per cent. Its plant food value is similar to cottonseed meal—a highly recommended organic fertilizer.

2. Digested sludge: This type of residue is formed when the sewage is allowed to settle by gravity, collected, and pumped to a digester. The conventional anaerobic digestion system takes about 10 to 14 days from the time the sewage reaches the tank until the digested solids are pumped into filter beds of sand and gravel for drying. The final step is removal of the dry material, either to be incinerated or used for soil improvement.

A few medium-sized cities located in argricultural areas dispose of a part of their digested sludge in liquid form. This is delivered to farmers within a radius of about 10 miles and is used for direct application to land.

Digested sludge has about the same fertilizer value as barnyard manure. Nitrogen varies from two to three per

Table 1 (Continued)

Prices of Sewage Sludge

City	Brand Name if any	Annual Output	Nitrogen	Phosphorus	Years Sold	Sales Trend	Price
Grand Island, Nebr.	.....	about 1 ½ ton per day	4.2	.....	.....	.....	.....
Omaha, Nebr.	.....	500-600 tons	2.5	1.5	16	Up	$1.00 per 100 lb, bagged $1.10. $15.00 ton delivered in bulk, grounded form
Flemington, N. J.	.....	80 tons	.....	.....	77	No change	.....
New Brunswick, N. J.	.....	2,100 tons	1.77	2.18	20	Downward	.....
Pennsauken, N. J.	.....	200 tons	.....	.....	33	Upward	.....
Santa Fe, N. Mex.	.....	500 tons	.....	.....	4	Upward	$2.50 per 100 lb, bagged ground
Schenectady, N. Y.	Orgro	250 tons	2	2	4	Upward	$1.00 per 65 lb, bagged
Fargo, N. D.	.....	12,000 tons	.....	.....	20	No change	$.50 per 1000 lb,
Oklahoma City, Okla.	Soil Booster Organic Fert.	.....	6 (fortified)	2	8	Upward	$3.60 per 100 lb,
Houston, Texas	Hou-Actinite	12,000 to 14,000 tons	5	3	7	Upward	Sold only in bulk $3.00 per unit of nitrogen, $.50 per unit of phosphorus
Roanoke, Va.	.....	1,688 tons	2.5	1.5	4	Upward	$.25 per 100 lb.
Fond du Lac, Wisc.	Fond du Green	2,000 tons	2	2	7	Upward	$2.00 per 80 lb, bag, $18.75 per ton
Milwaukee, Wisc.	Milorganite	70,000 tons	5.5	4	30	Upward	
Oshkosh, Wisc.	Oshkonite	600 tons	2.09	2.65	20	No change	Sold in bulk 2 bu.—$.25, cu yd—$2.00, Ground $3.00 cu yd No deliveries.
Sheboygan, Wisc.	.....	1,000 tons	1.96	1.65	11	Upward	$.50 per 80 lb bagged (retail local). Carload shipments price $5.75 per ton. (Sold to broker.)
Williamstown, Michigan (Compost undigested sludge and garbage)	.....	.....	2.1	2.1	1 ½ yrs. (in operation)		$40.00 per ton, F.O.B. the plant, Processor blends with peat moss, sells 3 qt poly-ethylene bags.

cent, phosphorus averaging about two per cent. It often has an offensive odor that persists for some time after application to a soil surface during cool weather. "This odor differs greatly in character, however, from that of raw sludge," Dr. Myron Anderson, senior chemist for the Agricultural Research Service at Beltsville, Maryland, states "since drastic changes have taken place during digestion. The odor from digested sludges may be eliminated by storage in a heap during warm weather."

This reminds me of the experience one editor of a trade publication in the public works field recently told me about. He had moved into a new home on Long Island and had the most common problem of how to build a good, permanent lawn. Because he knew about the value of sludge—especially on sandy soils, he contacted the superintendent of a local disposal plant and arranged to have him deliver several truck loads of sludge. The result—the most luxuriant lawn in his neighborhood. Side result—a next-door neighbor offended about the odor.

Several months later, this same neighbor wanted to know who to contact so he could have some sludge spread on his lawn. That's how the story ended—green lawn winning out over temporary smell.

Sludge Sales Snags

Marketing sludge on a successful commercial basis is not a simple task, as most plant superintendents realize. Enthusiasm on the part of plant operators and city administrators is not always enough to spark a demand for sludge among local gardeners and farmers. For example, in Maryville, Missouri, City Engineer Roger Higgins writes that "We do not sell any sludge—in fact we have a difficult time giving it away."

In Akron, Ohio, "there was a time a number of years ago when it was sold as Akra-Soilite but since the administration did not see fit to actually set the drying and selling of the

Table 2

State Reports—General Practice of Sludge Disposal

	State	Market	Token Fee	Free	City Use	Not Used as Soil Conditioner
1	Ala.	X-L	X	X	X-E	
2	Ariz.		X-L			X
3	Ark.		X-L	X-L	X-E	
4	Colo.				X-L	X
5	Conn.		X-L	X	X	
6	Del.					X
7	Fla.		X-L		X	
8	Idaho	X-L				
9	Ill.		X-L	X-E		
10	Ind.			X		
11	Kan.	X-L		X		
12	Ky.					X
13	Me.					X
14	Mass.			X-L		X
15	Minn.	X-L		X		
16	Mo.		X-L	X		
17	Mont.			X-L	X-L	
18	N. H.					X
19	N. J.			X		
20	N. Mex.	X-L			X-E	
21	Nev.				X-L	X
22	N. Car.			X-E		X
23	N. Dak.					X
24	Ohio.	X-L				
25	Okla.	X-L				
26	Penn.		X-L	X		
27	R. I.			X		
28	S. Car.				X-L	X
29	S. Dak.			X		
30	Tenn.	X-L		X		
31	Texas	X-L		X		
32	Utah					X
33	Va.	X-L		X		
34	W. Va.			X-L	X	
35	Wis.	X-L		X-L	X	
36	Wyo.			X-L	X	

Legend: X, General Practice; X-L, Limited Practice; X-E, Extensive Practice.

sludge up as a business, the cost of drying by make-shift methods and by grinding it by hiring a portable grinder was prohibitive."

Solving Problems

In order to come up with some suggestions for solving the marketing problems, let's examine some successful municipal operations where sales are increasing. You've already read the story about Schenectady, New York. Boise, Idaho is another good area where "excellent acceptance of the product has been promoted," according to plant superintendent A. J. Wahl. Following are our questions, Mr. Wahl's answers:

1. Do you have any research reports or general experience of gardeners and farmers who have used the sludge (B I Organic—3½ per cent nitrogen)?

Farmers are the largest consumers. One purchased 100 tons, ground to his specifications. Last year the normal silage (corn) per acre was 18 tons. The average where B I Organic was used in the seeding operation of corn planting was 27 tons of silage. Other uses by local gardeners include landscaping, lawn and shrubbery planting.

The Department of Agriculture has made analyses of the dry marketable sludge. All their analyses as to nitrogen content show that material contains ½ to one per cent above guaranteed figure on bag.

2. What kind of sales promotion efforts do you make?

We have not prepared any promotional literature or done any local newspaper advertising. Practically all retail outlets handle B I Organic locally and sell the same as a soil conditioner.

3. Do you have any suggestions based on your own experience on how the marketing of sludge could be improved and made more profitable to cities?

Here are some suggestions:

a) interest local farmers to use on such crops as hay, grain and corn;

b) interest local gardeners and greenhouse operators to use in putting in new lawns and transplanting trees and shrubbery for local trade;

c) all sludge to be sold in small amounts, as per sack. Sell through local distribution agencies;

d) sell direct to all users in ton or more lots—ground and in bulk to lower the unit price;

e) interest home builders and landscape architects in putting in new lawns and shrubbery;

f) interest the general public to apply product on existing lawns in the months of December and January. During this time, the winter snow and moisture will carry the nitrogen value to the root growth—eliminate any perceptive odor and exhilirate lawn growth in the spring.

Importance of Merchandising

The Soil Booster Corporation has been marketing sludge in the Oklahoma City area using the trade names, Soil Booster and Start-Rite. Sales Manager Ray E. Penn makes the following observations about marketing conditions:

"The marketing of sludge-type products hinges on selection of certain types of individuals as dealers. Of course the first consideration is knowledge of the dealer regarding plants and their requirements. Second consideration — good merchandisers. And last but not least, continuous striving on the part of the company for more and better information to be supplied to the dealer.

"Unfortunately, efforts in the past have been based upon products which do not meet the demand of the public. The first factor is that of reduction of odor, which can be controlled only by proper digestion and processing. The second requirement is that the customer wants faster growth than can be stimulated by sludge alone. Therefore, it is necessary to fortify many sludges in order to get the results they demand, and much educational work must be done in order to overcome the prejudices of the people

regarding this material because of its source.

"Another factor, in some cases at least, is the opposition of the public officials themselves. Another factor to be considered is the misinformation regarding the nutrition of plants and the so-called necessity of balanced fertilizer. Under this category we would also include the lack of knowledge and information regarding the soil, the function of the mineral elements, the function of enzymes, organic acids, antibiotics and other compounds necessary to plant growth. And might I say, in this connection, that it is necessary to lead people into the purchase of organic fertilizers by gradual methods, even though we know it is best."

How Much to Charge?

The retail price depends, of course, on the nutrient content of sludge produced, costs of producing it, and demand. Costs range from 25 cents per 100 pounds, not bagged (N—2.5 per cent, P—1.5 per cent) for Roanoke sludge to 3.15 retail price for an 80 pound bag of Boise sludge.

In Boise, the sludge is contracted to a local company. The sale price to the city is 40 cents per cubic yard as taken dry from the sand drying sludge beds.

Table 1 lists prices charged by various municipal plants.

Amounts to Use

The city of Marion, Indiana has printed an excellent little pamphlet which includes the following suggestions for using sludge as a fertilizer and soil builder:

"(1) For starting new lawns—prepare the seed bed by mixing the sludge with the soil. A maximum dosage of one part sludge to two parts soil may be used if the soil is of a heavy clay texture. Spade the ground to a depth of at least six inches making sure the sludge is thoroughly intermixed with the soil. Never have layers of sludge and layers of soil in the seed bed.

"(2) For feeding well established lawns—the sludge should be applied in the winter and early spring months when the ground is frozen. The lawn may be covered with a layer of sludge one-half inch deep during the cold months of December, January, and February. This cover will provide an insulation to protect the grass roots from the harmful effects of freezing and thawing during this time of the year. In addition, ample plant food will be made available for a luxuriant growth of grass in the spring.

"(3) For reconditioning old lawns—on yards or portions of yards where the soil has been too poor to support an average growth of grass, it is recommended that the procedure under (1) above be followed. It should be remembered that grass roots grow into the soil to a depth of six or seven inches only when the ground is of such a composition that will permit this growth. To top-dress and seed a section of ground that has not been properly prepared is a waste of time and money.

"(4) For gardens and farm land—sewage sludge provides an economical means of replenishing farm and garden land with nitrogen, phosphorus, and humus material. It should be put on the land just previous to the fall or spring plowing and cultivated in to the soil. The sludge cake may be applied as a manure to farm land at the rate of ten to fifteen tons to the acre. The weight of the sludge is approximately one ton to the cubic yard. It will be sold at a price far below that of any commercial fertilizer now on the market.

How to Use Sludge

In his report, "Digested Sewage Sludge as a Soil Conditioner and Fertilizer," Mr. Van Kleeck writes the following on how to use sludge:

"Sludge may be applied as a top dressing in the case of trees or lawns; in the hill in the case of melons, squash, or other vine crops; or spread, then plowed or spaded into the soil. When used as a top dressing, it should not be applied too thickly, especially on lawns, or it may choke the growing vegetation. Sludge may be applied when the ground is frozen or covered with snow. In such cases it is raked and pulverized into the soil in the spring.

"The pH of heat-dried activated sludge is low, generally averaging 5.0 to 6.0. Air-dried digested sludge after a short period of storage will normally show a drop in pH to about 6.0. Digested sludge cake conditioned with lime for vacuum filtration has initial pH values ranging from about 10.2 to 11.2, but this drops rapidly when it is mixed with soil or more slowly on storage, as a result of loss of amonnia. Tests show that pH of lime-conditioned sludges drops to about 7.5 in two or three days so that the danger of too alkaline a soil should not occur from the use of such sludge. Furthermore, experience shows that the continued use of any type of sludge unless previously conditioned with lime requires the periodic addition of lime to the soil to prevent harmful acidity.

How Safe Is Sludge?

". . . A special committee of the Federation of Sewage and Industrial Wastes Associations reporting on the "Utilization of Sludge as a Fertilizer" states: "The committee knows of no case of sickness traceable to the use of digested sludge or activated sludge."

In the U. S. Dept. of Agriculture report by Dr. Anderson on sludge he writes: "Activated sludges need heat-treatment before use as fertilizer. Such treatment is normally provided for material to be marketed. The heat used for drying normally accomplishes the destruction of dangerous organisms. This means that properly heat-dried activated sludges may be used with confidence regarding their safety from a sanitary standpoint. . . .

"It seems that States have generally accepted the conclusions of the Committee on Sewage Disposal of the American Public Health Association that heat-dried activated sludges are satisfactory from a sanitary standpoint, and that digested sludges are satisfactory except where vegetables are grown to be eaten raw. All danger is thought to be removed by action in the soil after a period of about 3 months during a growing season."

What About Results?

Table 2 shows the replies received from state officials concerning the experiences of cities that have been marketing sludge.

Here's what Mr. Van Kleeck says about the results of adding sludge to the soil: ". . . Sludge is particularly adapted to lawns. Sludge deepens the green color of grass and stimulates a luxurious growth. Its benefiits seem noticeable for several years. It should be applied late in March and again if desired early in September.

"The home owner may well use it for the flower garden. Here it provides a much needed humus for the hot summer months as well as a moderate but long yielding amount of nitrogen.

Operations building strikingly illustrates the "Design with a future," that is carried throughout the new . . .

Edmonds, Washington Sewage Treatment Plant

Operations Building

by HOMER HATHAWAY, Technical Writer,
Everett, Washington

ED. NOTE: This article tells how over 7 years of planning resulted in a sewage treatment plant that is able to provide service for approximately eight times the present city population, at very little additional cost.

■ A $200,000 SEWAGE TREATMENT PLANT was completed and put into operation in the city of Edmonds, Washington in December of 1957, after about seven years of planning and exploration of financing. Although this may seem like a lengthy period of time to get such a project from the drawing boards into reality, it was an investment of time which has paid off with a facility that is so constructed as to be able to provide service for approximately eight times the city present population (4000) without too much additional cost. The city is mushrooming rapidly as people move from Seattle to escape the congestion of a large city.

The problems facing the engineering firm, James H. Reid and Associates, were of a size to match the rugged Olympic mountain range which Edmonds faces across Puget Sound to the west. Puget Sound played an important part in the problem of providing an adequate sewage disposal system, also, since the discharge of such wastes eventually ended up in the sound.

Old System Created Multiple Problems

Portions of the city sewage system dated back to at least 1910, with the basic concept consisting of sanitary and storm sewers emptying directly into Puget Sound. As the city expanded, sewers were repeatedly extended to receive both sewage and street drainage from the new areas. This pattern had carried right into World War II, with a consequent development of serious problems.

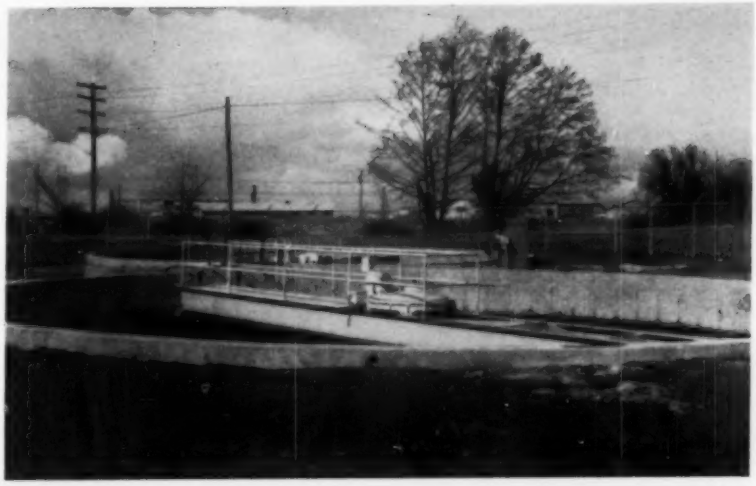
Storm waters were causing overloading of the sewer system at many critical points, resulting in overflow of manholes in the main business area, flooding of basements, and creation of flood damage to valuable property. Pollution of Puget Sound became so bad that the beaches were condemned by health authorities, so that bathing and clam digging were no longer allowed.

Immediately following World War II Edmonds took some stop-gap measures, including extension of the sanitary sewer outfall at the foot of Dayton Street several hundred feet further into the sound, construction of storm overflow facilities at this general location, and enlarging the main sewer at one or two critical points in the main business area.

Edmonds Requested to Effect Remedies

In 1950 the Washington State Pollution Control Commission and the Washington State Department of Health suggested that Edmonds officials get busy and do something concrete to solve their problems. An engineering firm was hired and a re-

port was submitted with certain recommendations but for various reasons this report and its recommendations were not followed, principally because of the cost involved. However, in 1953, the firm of James H. Reid and Associates, a local firm, was hired to develop plans for sewage treatment facilities and also a financial advisor was retained to work out details of a revenue bond program for financing the necessary construction. On April 15 of that year the Reid firm submitted a report for accomplishment of a stage construction program setting forth an estimate of $181,500 for the building of sewage treatment facilities.

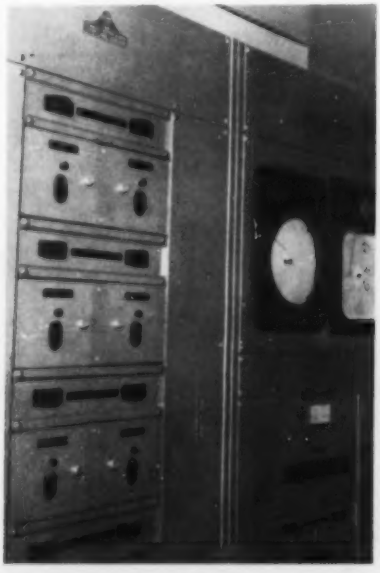


CLARIFIERS now in use. Area has been laid out to accommodate three additional units when needed.

City's Actions

The city took the following action to bring about the realization of the engineer's recommendations:

(A) On June 16, 1953, the city council adopted an ordinance which combined the city water and sewer utilities into a single utility department, authorizing sale of revenue bonds to the amount of $275,000 ($200,000 for sewerage facilities and $75,000 for water supply improvements), and directing the immediate issue of $135,000 ($95,000 for sewerage facilities and $40,000 for water supply improvements).



CONTROL PANEL also features areas for installation of additional control equipment at a future date.

(B) Plans and specifications were prepared and construction accomplished for unit 1 of the storm water separation program, at a cost of $43,700.

(C) Extensive additions to the city's sanitary sewer system were constructed under a local improvement district.

(D) Effective August 1, 1953 the city increased its water billing by the amount of $1.40 per month to provide adequate coverage for repayment of its authorized revenue bond issue.

Early in 1954 the city made plans for the installation of sanitary sewers in the unsewered area of South Edmonds. The Pollution Control Commission urged that action be taken to provide sewerage treatment facilities prior to or coincident with the construction of such additional sanitary sewers. Such an agreement was reached, and a preliminary engineering study was submitted to the council in August of that year. This report developed new findings and recommendations in regard to treatment plant location, route of interceptor sewers, etc.

Site Selection

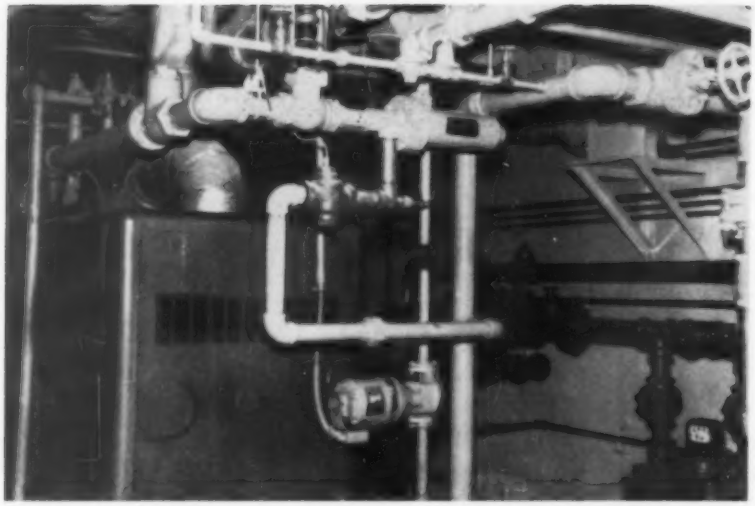
Selection of the site was one of the most important considerations, since the previous site suggested had been proven to be unfavorable from the standpoint of foundation conditions, the existing 24" trunk sewer would require pumping of all incoming sewer to a high level, such pumping tending to draw in huge amounts of water from the swampy area of the location, as well as entailing excessive pumping costs, with poor control of storm overflow.

However, at the site finally chosen the sewage flow is carried into and through the plant by gravity without pumping, thus providing minimum pumping costs; the plant is located on solid ground free of swamp muck, with the route of the interceptor sewer lying on firm ground throughout, and was constructed at reasonable cost; the existing 24" trunk sewer on Dayton Street westerly can be utilized for conveying plant effluent and storm overflow without major rehabilitation; the chosen site permits the economic diversion of sewage from the Dayton Street trunk well above the effect of high tides, and the easy installation at that point of positively regulated and adjustable storm overflow weirs, for by-passing of necessary portions of very heavy storm flows which can occur in this area occasionally.

Physical Plant

The physical make-up of the sewerage treatment plant consists of the following:

Storm overflow structure on Dayton Street, with adjustable weir for possible by-passing of portions of excessive storm flow which may occur



FURNACE and piping in basement of operations building. Piping has already been installed to accommodate additional clarifiers when added to plant.

in the Dayton Street trunk sewer; combination screen and grinder (with bar screen by-pass) for comminuting all sewage solids entering plant; grit removal channel, grit pump, grit separator and sewage return piping, for automatic hydraulic removal of grit from sewage ahead of clarifiers; Parshall Flume, for flow measurement and automatic control of chlorination; initial construction of two circular clarifiers, 40 feet in diameter by 8 feet side water depth, with mechanical sludge collectors and scum removal; provision for ready plant expansion by construction of one to three additional identical clarifiers, at adjacent locations; clarifier sludge draw-off piping and manually operated telescoping sludge draw-off valves at a central sludge collection box; sludge pump, piping and control valves in the operations building basement; sludge digester, 40 feet in diameter with 20 feet inside depth above the top of the bottom cone; digester sludge mixer (propellor and draft tube type combined with hot water heat exchanger; sewer gas (or LP gas) fired hot water boiler in operations building, with piping and automatic controls for maintenance of constant optimum temperature in the digester; digester gas collection, piping and control facilities, waste gas burner, etc.; digester sludge truck fill stand; septic tank sludge receiver and appurtenances; standby low-head sewage lift pumps, controls and appurtenances, for discharge of clear plant effluent under extreme high tide and flow conditions; operations building, 16′x24′, including sink, cabinets, laboratory equipment, chlorination room, lighting, electric panels, basement sump pump, etc.; gas-solution type chlorinator, with necessary controls, piping and appurtenances, for automatic chlorination of effluent.

Total Design Capacity 4.85 Mgd

The design provides not only for an initial capacity of approximately 1.95 MGD with 2-hour clarifier detention time, but an ultimate capacity (with a total of five clarifiers and addition of a second stage digester) of approximately 4.85 MGD.

With the help of a federal grant, the financing of the plant was completed and it has now been in satisfactory operation since being completed in December of 1957.

By planning ahead to a definite increase in population, Edmonds taxpayers have provided a plant that will continue to serve without major expenditures for many future years.

Equipment, Manufacturers

DORR-OLIVER
Clarifier Equipment (40′ ⌀ Clarifiers)
Dorr-Clone (Grit separation)

CHICAGO PUMP CO.
18″ Barminutor
Sewage lift pumps

BRISTOL METER CO.
Flow-recorder
Recording thermometer (digester temperature)

AMERICAN WELL WORKS
Comminuting sludge pump (vertical-centrifugal)
Sludge drawoff valves

MAGNATROL
Float switches

VARIC
Gas controls

AMERICAN STANDARD
Boiler

WALLACE AND TIERNAN
Chlorination

SLUDGE DIGESTER. Note special fill-stand and piping for sludge trucks. Sludge is sold by a local fertilizer company.

After two years of experience, Israel now grows cattle fodder and raises ground water tables by pumping . . .

Sewage Effluent into Sand Dunes

by DR. ING. YEHUDA PETER, Associate Professor for Hydraulics, Technion-Haifa, Tel-Aviv, Israel

■ IN A SEMI-ARID COUNTRY like Israel, water is precious, and man is obliged to make the best use of all sources of this important material. Therefore, the proposed new water law and the general national water scheme regard sewage as a water source in its own right.

A considerable part of Israel's urban population is concentrated in what is designated as the "Dan Region," which comprises Tel-Aviv and a number of surrounding towns. The necessity of building a regional sewerage system brought up the question of putting to economical use several tens of million cubic meters of sewage per year. The solution ultimately envisaged is the transfer of the effluent to the Negev desert, by large, extensive pipelines, but for economical reasons a short term solution, needing less capital and time, was required.

The Holon suburb, to the South of Tel-Aviv, with a present population of 45,000 inhabitants and an area of 19,000 dunams (4 dunam—1 acre), forms part of this sewerage scheme, but its inclusion into the system is scheduled for a later date. An intermediate solution was therefore required. The presence there of an unused large sand-dune area in the immediate vicinity suggested an irrigation scheme, which includes several additional possibilities and purposes, thus promoting a mere stop-gap proposal to a justified permanent solution.

LUCERNE FIELD illustrates cover growth after sprinkling.

The effluent of a number of simple primary treatment sewage plants is pumped and distributed by sprinklers on the sand-dunes, after submitting the land to a minimum of regrading. Experience to date indicate no nuisance by odors in a built-up area located 300-400 meters away. The soil characteristics are: 1) Sand grain diameter, from 0.1 to 0.3 mm; 2) Uniformity No. 2; 3) Thickness of sand layer, from 4.0 to 7.0 m; 4) Average elevation is 20 meters above MSL; 5) Distance from the coast, 2.5 km; 6) Nature of strata underlaying the sand-dunes: Sandy loam; and 7) Elevation of ground water level above MSL: about ± 6 m.

Up to now 225 dunams have been cultivated for two years. The rate of application is 8-10 cu m per day/dunam for 200-250 rainless days per year. The precipitation during the rest of the year is about 500 mm. The crops grown are cattle fodder. Within the first irrigation cycle the sand is turned into good humus, with no visible difference between the effluent sprinkled sand and normal agricultural soil; the shifting dunes become stabilized, which is an additional advantage of this disposal system. Excellent results have been obtained from this method.

A natural depression has been set aside as an experimental percolation area. By the experience of two years it has been established that the permissible rate of application is 80-100 cu m per dunam per day, or about 10 times the desirable rate used for agricultural purposes, and has resulted in an increase of the elevation of the ground water table by several decimeters. As the ground water level has been sadly depleted by overpumping and is endangered by salt water intrusion, the above method of recharge serves a dual purpose. Though it involves giving up some agricultural gain, the required area represents actually only the tenth part of the land required by the cultivation method and provides thus for a certain measure of elasticity, allowing for change in the use of the land with proceeding urbanization.

MOVABLE SPRINKLER lines. Note difference in soil coloring.

A STAND of Elephantine grass illustrates growth potential.

PERCOLATION pond allows rapid application rate; elevates water table.

Penna. State Univ. host to the annual conference for the 30th year displayed local progress in . . .

Treatment Facilities

H. W. McElhaney
President

S. I. Zack
1st Vice Pres.

A. A. Estrada
2nd Vice Pres.

EDITOR'S NOTE: One afternoon of the three-day conference was devoted to an inspection of the State College sewage treatment plant. A formal resume of each unit's design factors, operating efficiency and trouble spots was followed by a general tour and on-the-spot observation of the comments discussed.

The program for the conference provided ample opportunity for all members to discuss problems and progress in the field. Separate sewage operators' and industrial wastes roundtable discussions headed the program. This was followed by breakfast sessions and formal presentation with formal and open discussions.

Subjects covered included safety, design and operation of sewage treatment plants, and the relation of phenols to taste and odor problems.

■ OFFICERS ELECTED for 1958 are Harry W. McElhaney, President; Samuel I. Zack, 1st Vice President; and Alfred A. Estrada, 2nd Vice President. Bernard S. Bush, past president, was elected to fill the position of director vacated by Roy F. Weston.

Alfred A. Estrada, of Albright & Friel, Inc., Consulting Engineers, was named the outstanding man in the PSIWA. Howard P. Reuning received the Bedell Award and King H. Hendrickson received the Hatfield Award.

The "Sludge Shoveler's Society" conceived by Ted Moses in 1937 was renamed the "Ted Moses Sludge Shoveler's Society" in honor of the late Mr. Moses. The activities of the society have been incorporated into the PSIWA by-laws, thus deeming it a legal association honor to be crowned with the "High-Hat" and receive the engraved sludge shovel tie clasp.

During the conference, many sessions on sewage and industrial wastes were held concurrently. Abstracts of papers presented and highlights of sessions related to sewage works are:

■ GENERAL SUMMARY OF ACTIVITIES: The Penna. State Univ. Sewage Treatment Plant design requirements and features were reviewed. The plant incorporates mechanical barmunitors, preaeration primary settling tanks, low and high rate trickling filters, primary and secondary sludge digestion and vacuum filtration of digested sludge. Problems associated with pest and odor control, sludge collector flights, digester covers, return of seed sludge, solids settling in the distribution channels of the primary, and the efficiency of the plant were discussed and physical corrections observed, where applicable, during the afternoon field trip.

The breakfast sessions and formal discussions centered mainly on control and analysis of waste waters and waste treatment methods. Such subjects concerned: Desired analyses for digester control, correction factors for BOD when blanks have inconsistent D.O. drops, the Wyatt colorimetric tests for BOD, COD in comparison to BOD results before and after acclimation periods for complex chemical wastes, and the use of the CENCO Moisture Balance manufactured by the Central Scientific Co., Chicago, Ill. (Cat. No. 26675) for speedy solids determinations. Additional discussion on effluent standards versus stream standards, linings for corrosive waste storage tanks, sampling of industrial waste in municipal sewage, and methods for selling industry on process control and less wastage, are only a few of the many subjects upon which the members exchanged ideas.

■ PHENOL CONTROL OR TASTE AND ODOR CONTROL? by John E. Kinney, Sanitary Engineering Consultant.

Is phenol concentration of raw water a true indicator of taste and

odor quality of potable water supplies? In the Beaver Falls, Pa. study, there was no correlation between the phenol concentration and the intensity of odor; however, the chlorine demand of the raw water and odor were related. A high chlorine demand resulted in an intense odor problem.

A survey of water treatment plants in Pa., Va., Ohio and W. Va. disclosed that taste and odor problems were not continuous throughout the year. Intense taste and odor problems were associated with periods of high stream flow and heavy surface runoff. Problems were also associated with industrial cleanouts. Wastes from these cleanouts contained high organic and low phenol concentrations. The control of cleanouts corrected the taste and odor problems.

At Youngstown, Ohio during the 11 days when phenol concentrations were 50 ppb, no taste or odor problems occurred; however problems did occur in the 25 days when the concentration was 2 ppb. In all cases when phenol was considered the cause, the concentration was low, not high. This suggests that other organics were present and the cause of the problem. Although odors are derived from the chlorination of phenols, chlorination practice can be controlled to eliminate such occurrences. No problems have been experienced in instances when raw waters had low chlorine demands, low organic content, and high phenols concentrations.

There is no concentration of phenols below which no taste and odor problems can be assured of not existing unless a survey of all pollutional loadings to the water course is made and related factors considered. The control of taste and odor can not be assessed to any one specific constituent such as phenol.

B. S. Bush
Director PSIWA

J. E. Kinney
Phenols

■ Formal Discussion of Mr. Kinney's paper by Dr. Richard D. Hoak, Senior Fellow, Mellon Institute, Pittsburgh, Pa., state regulatory agencies require less 5 ppb phenols in waste water effluents while Pennsylvania has a requirement for no phenols in waste discharges. There is acceptable proof that other factors beside phenols are of importance to taste and odor problems. Also, that other materials such as oak leaves may be a source of phenols that appear in surface waters. Dissolved solids may even play a part. To pin-point the problem, considerable more research must be done on the subject.

■ Formal Discussion by Dr. M. B. Ettinger, Chief Chemistry and Physics, WS&WP Program, USPHS, Cincinnati, Ohio. Phenols are analogous to the coliform index in water quality. Phenols are considered as an indicator of poor self purification of streams. Other chemicals and organics are present if phenols are present. Dr. Ettinger was not in agreement with Mr. Kinney's views concerning phenols as an improper parameter for establishing quality of potable waters by the association of taste and odor problems to phenol concentrations.

■ Safety Practices in Chlorine Handling by Douglas E. Dismukes, Field Engineer, Fischer & Porter, Philadelphia, Pa.

There are ten basic rules to follow when handling chlorine containers (1) Don't drop the cylinders, (2) Use a truck to move cylinders, (3) Store cylinders upright, (4) Check and replace gaskets on the chlorine supply line periodically — especially the one between the cylinder and manifold connection, (5) Use only graphite for lubrication, (6) Always open valves slowly, (7) Keep cylinder and discharge piping at the same temperature —if difficult, then cylinder should be at a lower temperature, (8) Don't withdraw chlorine from the tank too fast and upset the temperature-pressure relationship of liquid to gas heat requirements, (9) Never apply heat to a cylinder and protect them from the weather, and (10) Maintain a separate room for chlorination equipment and never remove heads from cylinders until they are to be put into use.

The maximum safe withdraw of chlorine from any size tank or cylinder is 425 lb/day. If for any reason a container is damaged it should be placed so that gas rather than liquid escapes (one pound of liquid will produce 5 cu ft of gas).

Since chlorine is heavier than air, a person should always hold his head high and breath slowly when evacuating areas where chlorine is escaping. Aqueous ammonia remains as the best item for use in locating chlorine leaks. Persons are cautioned in the use of canister gas masks, because no protection can be expected from their use after periods in excess of 15 min in high concentrations of chlorine gas and not more than 2 hrs in low concentrations. Gas masks are of value for use in concentrations of chlorine up to only two per cent.

Hyperion Engineers Inspect Test Pump Model

Engineers from the Hyperion Sewage Treatment Plant, Los Angeles, Calif., recently examined a scale model of a 54-in. YV pump on the pump test floor at Allis-Chalmers West Allis Works.

The engineers were inspecting the progress of the three big pumps plus all of the operating equipment for the new Hyperion effluent pumping station, which A-C is building.

The 14-in. model is a replica of the three 54-in. pumps which will go to the new pumping station next year. The 54-in. pumps are rated 120,000-gpm at 80 ft head. Three 2500-hp motors, the largest vertical wound-rotor motors ever made by A-C, will operate the pumps.

Besides the three pumps and motors, the engineers checked on their order for three 60-in., three 78-in., and one 120-in. butterfly valves; three liquid rheostats; and control and switchgear equipment.

The 2nd Annual State-wide meeting concerned . . .

Pollution Abatement

EDITOR'S NOTE: The Ill. State Chamber of Commerce through its Water Resources Committee sponsored a one day conference on pollution abatement to inform business, civic and government leaders of their responsibilities toward protecting the state's water resources. The main session was attended by approximately 325 persons who represented 81 communities and 8 states.

Non-technical presentations were directed at the problems created by water pollution. The expressed need for cooperative action throughout the state and a discussion of the best approaches toward solving existing problems were designed to show community leaders what they may do to organize local corrective action.

The state of Illinois has set a precedent in their efforts to bring the problems of protecting water resources to the public. Authorities have recognized available water supplies as one of the basic factors responsible for the economic growth and prosperity of the state and the wellbeing of its citizens.

■ THE ONE-DAY PROGRAM of the Water Supply Conference featured non-technical presentations designed to provide useful and practical information to interested citizens throughout the state. Government officials realize that the polluting of Illinois water resources will severely hamper and limit the full utilization of streams, rivers, lakes and the underground resources. The increasing demands for water can not be met unless there is protection and intelligent development of these natural assets. The availability of water supplies has been one of the basic factors responsible for the economic growth and prosperity of the state.

Maj. Gen. Emerson C. Itschner, Chief of the U. S. Army Engineers, presented a luncheon address concerning America's water resources. The General spoke of the recently enacted Public Law 500 which authorizes the Corps of Engineers to include storage as an additional factor in constructing flood control reservoirs for present and anticipated municipal and industrial needs. It also permits the modifying of existing flood control projects to include water supply storage. Reservoirs built primarily for flood control are now providing municipal water supply to 38 cities.

The problem has been and will be the cost to these specific municipalities, industries and other users who wish to benefit from federal projects designed to control water courses. Users should pay their share of the cost.

Many valuable water storage sites have been used for flood control reservoirs. These flood control dams are inadequate for service as water supply reservoirs. At the time of their construction they were known to be inadequate for this ultimate purpose but communities were unable to enter into the contracts to share the cost at the time of their construction.

Water supply, like other water resources functions must be fitted into a pattern of coordinated river basin development which here-to-fore has been confined largely to navigation improvement, irrigation and flood control. The federal interest is now expanded to include not only water supply but hydroelectric power, the disposal of urban and industrial waste, public recreation and wild life.

■ WHAT IS POLLUTION? by Milton P. Adams, Exec. Sec. Mich. State Water Resources Commission, Lansing, Mich.

The pollution of water is associated with water rights. Most of the United States recognizes the riparian doctrine of reasonable use of water resources. This includes the use of bodies of water for waste disposal.

In addition to water courses serving their natural purpose, man has long relied upon water to rid him of all types of waste. Municipal and industrial wastes are the chief offenders of the reasonable use qualification. Water rights are also associated with quantity as well as quality in usage of supply and disposal of wastes. The ever increasing demand for supplies to service additional bathrooms in homes, washers, air conditioners, industrial equipment, etc. add to the waste carrying burden of available water resources.

The effects of pollution or imposition upon water rights result in oxygen depletion, taste and odors, toxins, sleeks, dissolved or inert matter and any other chlorination of the water making it unfit for the intended use. The treatment required to protect these resources differs in all cases and again is associated with the intended use. Complaints concerning use may come from varied downstream users including fisherman, farmers, sportsman, active outdoor enthusiasts and many other clubs and associations. Under Public Law 660, many of these complaints have been carried into court.

The recommendations of the pollution control advisory board suggested that the federal government encourage more research, allow early tax write-offs for industrial and municipal treatment plant construction or improvement, and set out on an educational program to make the public aware of the pollution control problem. The public must be made aware of what polltion is.

■ A LOOK AT THE ILLINOIS SITUATION by Clarence W. Klassen, Chief Eng., Ill. Dept. of Public Health.

Illinois has 1240 miles of border, 945 of which is water boundry. It is

a recreation state with over 500 inland lakes and sites for an additional 600 potential lakes. There are 1147 miles of navigable stream on which 20 million tons of cargo are handled annually.

Large metropolitan areas use 1.5 bgd of water and discharge a like amount as waste water. Agriculture, a $2 billion annual business utilizes 33.5 bgd. Industry requires 8 bgd for process waters and the hydro-electric power generated daily demands 21 bgd.

Water in Illinois serves a galaxy of purposes and is almost equally important to the variety of uses essential to the state's economy. The protection of this natural resources through pollution abatement has neither been promoted or retarded by any dominating pressure group.

The chief factors contributing to the advance in the field of pollution abatement are:

1. The difficult and costly sewage treatment problem in the Chicago metropolitan area. Due to the unique position of sanitary district being responsible directly to the state legislature, it has kept the law makers conscious of the engineering, financial and legal problems involved in the collection, treatment and disposal of municipal and industrial wastes.

2. A public that is aware of their legal rights, the dangers and needlessness concerning foul streams.

3. Progressive legislation through the years beginning with the birth of the sanitary district in 1917 to the present day total of 35 such districts.

4. The activities of the State Sanitay Water Board having the complete support of the Governor, Attorney General and executive offices of state.

5. The development of sound engineering approach to domestic and industrial waste treatment problems.

The approach in Illinois is for the utilization of streams based upon their ability to assimilate waste. This includes due consideration of the physical, chemical, biochemical, biological and bacteriological conditions in addition to the hydrologic factors of the outlet water resource. It is recognized that no single standard for either the stream itself or the treated waste effluent is applicable to all waters of the state. It is further recognized that the economics involved in the treatment of wastes must be consistent with the usage of the receiving stream.

The industrial waste policy of the Sanitary Water Board is to prevent and abate pollution through waste utilization within the industry. The approach is toward requiring industry to do the minimum possible which will maintain the stream for its legitimate uses. It is the state's responsibility to evaluate industry's outlet and specify the reduction necessary to protect the stream users at that point. It is industry's responsibility to find the solution to any teatment problem.

■ A Positive Approach to Industrial Waste Control by Dr. C. S. Boruff, Hiram Walker & Sons, Inc., Peoria, Ill.

Few people expect our surface waters to be returned to the purity they enjoyed when the white man came to this country but fewer will tolerate these water courses becoming open sewers. Agriculture, municipalities, business and industry must all be diligent in their efforts to lighten the waste load to our surface waters because the potential waste load to our surface waters will increase with the anticipated growth in urban population and industrial activity. Surface waters must be used and re-used to meet future demands due to dwindling ground water resources.

Recovery and treatment procedures for industrial wastes is basically the responsibility of each industry in conjunction with minor roles of state, interstate and federal bodies. Fellow industries should:

1. Recognize pollution when and where it exists and act in a positive manner toward abatement.

2. Control potential pollution before it occurs and educate company personnel to this approach.

3. Know the waste load of each of the processes and of the plant as a whole. Waste bottling-up, recycling, recovery and, if necessary, treatment should be included in design and construction. A carefully planned and executed waste abatement program produces added profits.

4. Advise the community of waste abatement progress and accomplishments.

5. Assay and solve pollution problems in cooperation with those industries which have similar wastes.

6. Be active in the community by assaying and solving municipal waste problems, especially if the municipal plant handles industrial wastes.

7. Be active in current programs which aware the general public of water resource and water pollution problems.

In general, industry has recognized and is recognizing its waste problems and its responsibilities for protecting the most essential of all resources—water. No one has a greater stake than industry in the management of water resources. Without water of usable quality and in needed quantity, there can be no industry.

■ Roadblocks to Pollution Abatement by Blucher A. Poole, Tech. Sec. Indiana State Pollution Control Board.

The Indiana experience should be universal. The main drawbacks to progress in effective pollution abatement are: public apathy, costs, legislation, ineffective treatment plants, insufficient salaries for employees, the urban move of the population, overloaded collection systems and lack of research.

The average man has no knowledge nor interest in pollution abatement unless he is directly affected. He may be directly affected if the municipality in which he lives desires to float a bond issue for construction of sewage treatment facilities. He is then awed with the cost of such a project and associates more importance to other public works, such as education, from which he directly benefits with his tax dollar. The citizen is accustomed to obtaining his public works piece meal and not in one lump sum, the cost of which is frightening.

Many waste treatment plants presently in operation are overloaded or poorly operated. Poor supervision is associated with low salaried employees and lack of respect for the need of pollution abatement.

With the changing environment and character of municipal and industrial waste, continuous research is necessary. Many of the present systems are inadequate for treating the type of wastes received. One can only be optimistic concerning the future, however, because the American Society, which has displayed the capability of harnessing the atom and overcoming polio, need only be convinced of the importance of protecting our water resources—then extensive and concrete accomplishments will be realized.

The Editor's Comments

Who Will Replace Them?

In the news columns of this issue are obituaries of two well known men in this field—L. L. Hedgepeth and I. M. Glace. Last month a similar notice appeared about George H. Jewell; in September it was Seth Hess and Ed Molitor; in August, J. K. Hoskins and W. L. Havens. Dr. Edward Bartow died in April and Frank Flood in February.

That other prominent men in our field will die or retire next year and the years after cannot be doubted, but the question arises, "Who will replace these men?" It is axiomatic that no one is indispensable, at least insofar as his professional life is concerned. He will be missed as a friend and as an individual, but someone will take his place in his field of work. True, no one will ever exactly fill the departed one's place, nor should he try to do so. I, myself, replaced a great editor within the past year, but I have no intention of trying to "fill his shoes"; I desire only to do the best I can to be myself.

In the broader view, the great loss is not the individual himself but his capacity to work, his long training, his hard earned experience, his sage counsel and his intimate knowledge of the field. These are the things that are not replaced.

Where are the trained young men coming from to take over responsibilities as we lose more men in this field of expanding size and opportunity? More than a decade ago, Vic Weir, a past president of AWWA, pointed out that the average age of members of AWWA was 48 years. Approximately the same average held for FSIWA. In the past 10 years, that average age has gone up, not down. Our field has not attracted enough young men.

The number of men either studying or majoring in Sanitary Engineering in our engineering schools throughout the country is pitifully small compared to the needs to fill this growing field. Why? The answer is simple; the field is not attractive from the standpoint of financial return. In order to interest young engineers, we must pay higher salaries; this undoubtedly means higher rates for water and sewage service, but these conditions must come.

As the average age of our profession goes higher, and as more of our elder professionals (and some not so old) die or retire, one can be justified in asking "Who will replace these men? Who will replace their experience, their judgment, their know-how?" If we are to have good replacements available, we must draw more young men into the bottom eschelons of our profession. To do so, we need the concerted efforts of AWWA, FSIWA, other organizations and the professors of sanitary engineering, all aiming toward raising the economic level of men engaged in this business.

Water Rates

A report in this issue, on the N. Y. Section AWWA meeting in Lake Placid, reviews two papers of importance to water works managers (and sewage works managers too). These papers deal with the important matter of money, money for expanding facilities to meet demands and money for improved operation to provide adequate service to customers.

Dr. Frances Stone, one of the speakers, pointed to the growing backlog of needed construction. I shall comment on this in our January issue. Now, I want to comment on water rates.

As part of this N. Y. Section meeting, John H. Murdoch, Jr. spoke on the symptoms and treatment of inadequate water rates. Prior to his presentation, data were presented from the annual report of Bath, N. Y. where the municipality owns and operates all three utilities, electricity, gas and water. Mr. Brooks Lapp is Manager of Utilities.

From that report, come these data on three utilities that serve the same customers.

	Elect. Dept.	Gas Dept.	Water Dept.
Fixed Assets	$610,553	$336,592	$498,907
Operating Revenues	$280,300	$289,669	$65,209
Operating Revenue per $ of Fixed Assets	$0.46	$0.865	$0.134
Operating Expenses	$255,998	$259,709	$55,152
Operating Expenses per $ of Fixed Assets	$0.42	$0.765	$0.114
Gross Income per $ of Fixed Assets	$0.0393	$0.0885	$0.0207
Retained Cash per $ of Fixed Assets*	$0.018	$0.0797	$0.005

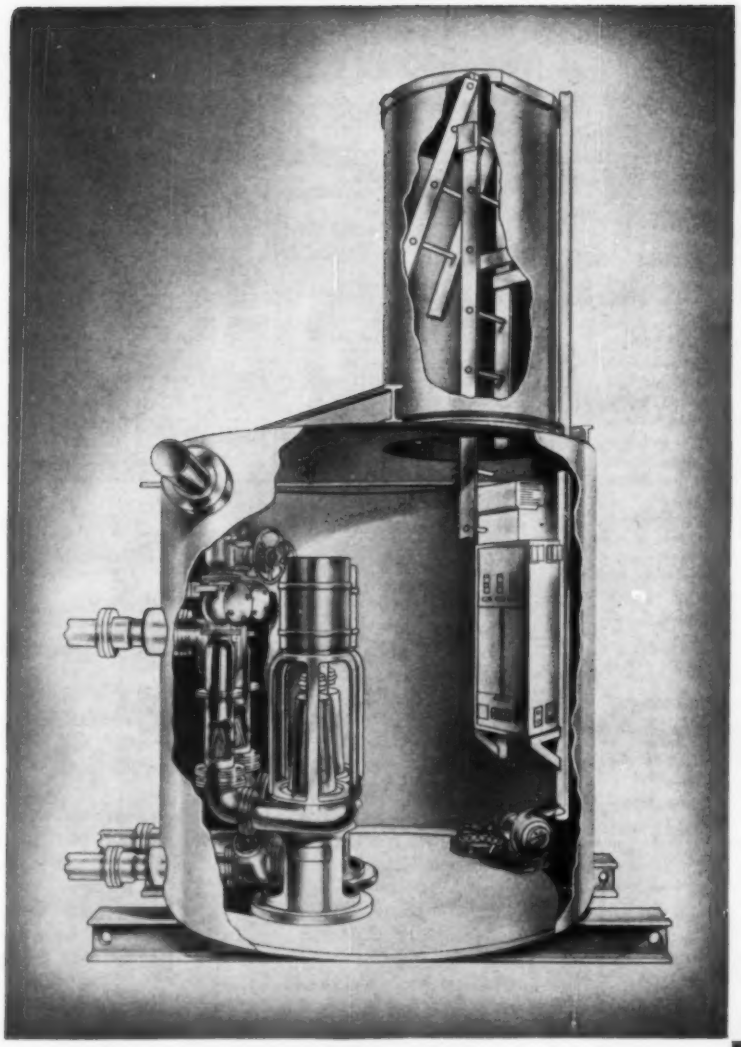
*After contribution to city general fund and payment of interest on bonds, etc.

Mr. Lapp, Manager of the Utilities in Bath, pointed out that in the case of both the electric and gas utilities, more than 90 per cent of the present fixed assets had been purchased out of income since acquisition of the utilities for a small investment; in the case of the water utility, however, almost all of the fixed assets had been purchased by monies obtained from the sale of bonds.

While municipal water utilities in New York cannot accumulate a reserve for capital expansion, it is obvious from these data that this water utility has water rates so low that it could not possibly accumulate any reserve for needed expansion.

It is not my intent to condemn the City of Bath, but these data give good proof of Mr. Murdoch's statement a few years back that "we have had 75 years of too cheap water."

George E. Symons.



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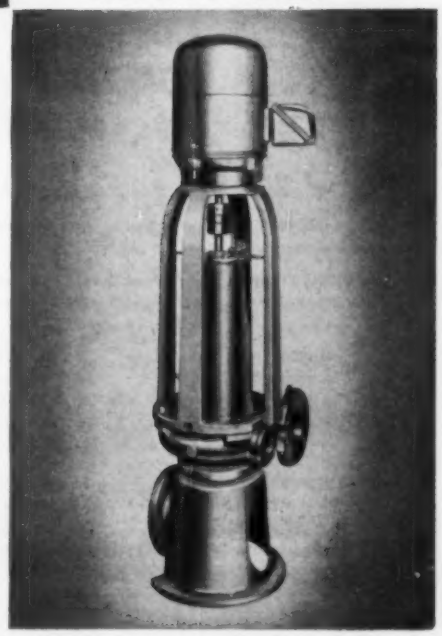

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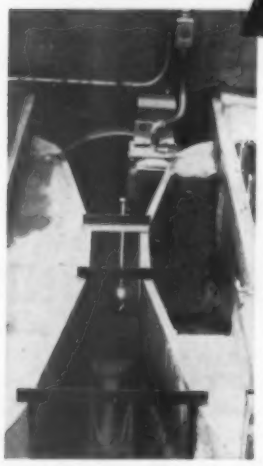

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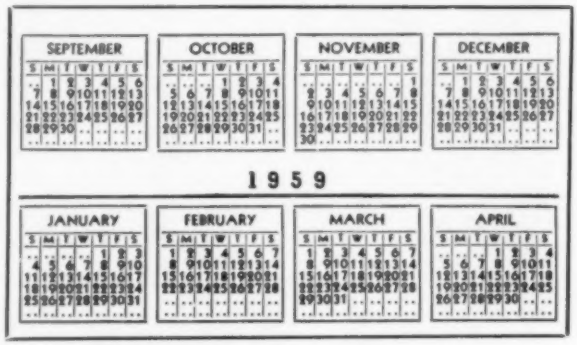


Nov. 5-7—Richmond, Va. *(Jefferson Hotel)*
VIRGINIA SECTION, A.W.W.A., Secy., J. P. Kavanagh, Dist. Mgr., Wallace & Tiernan, Inc., 213 Carlton Terrace Bldg., Roanoke, Va.

Nov. 5-7—Allerton Park, Ill. *(Univ. of Illinois)*
7TH ANNUAL WATER WORKS MANAGEMENT SHORT COURSE, T. E. Larson, Head Chemistry Section, State Water Survey Div., Urbana, Ill.

Nov. 6-7—Lincoln, Neb. *(Lincoln Hotel)*
NEBRASKA SEWAGE & INDUSTRIAL WASTES ASSN., Secy., V. J. Lechtenberg, 614 Standard Oil Bldg., Omaha, Neb.

Nov. 7—Columbia, S. C. *(Heise's Pond)*
SOUTH CAROLINA WATER & SEWAGE WORKS ASSN., Secy., Thomas P. Anderson, State Board of Health, Columbia, S. C.

Nov. 10-12—Greensboro, N. C. *(O'Henry Hotel)*
NORTH CAROLINA SECTION, A.W.W.A. AND NORTH CAROLINA SEWAGE & INDUSTRIAL WASTE ASSN., Joint Meeting, Secy., W. E. Long, Jr., State Stream Sanitation Comm., Raleigh, N. C.

Nov. 14—Columbia, S. C. *(Jefferson Hotel)*
SOUTH CAROLINA SEWAGE & INDUSTRIAL WASTES ASSN., Secy., Thomas P. Anderson, State Board of Health, Columbia, S. C.

Nov. 17-21—Stillwater, Okla. *(Okla. State University)*
32ND ANNUAL OKLAHOMA WATER & SEWAGE SHORT COURSE, Secy., H. M. Crane, Okla. State Dept. of Health, 3400 North Eastern, Oklahoma City, Okla.

Nov. 20—Boston, Mass. *(Hotel Statler)*
NEW ENGLAND WATER WORKS ASSN., Secy., Joseph C. Knox, 73 Tremont St., Boston 8, Mass.

Dec. 7-10—Cincinnati, Ohio *(Netherland Plaza Hotel)*
AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, Annual Meeting, Secy., F. J. Van Antwerpen, 25 W. 45th St., New York 36, N. Y.

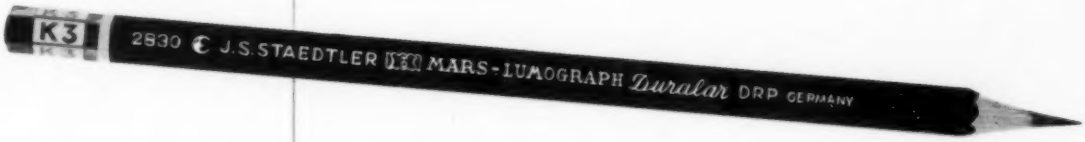
Dec. 11—Biddeford, Maine.
MAINE WATER UTILITIES ASSN., Secy., Gerard F. Laurin, 89 Western Ave., Augusta, Maine

Dec. 18—Boston, Mass. *(Hotel Statler)*
NEW ENGLAND WATER WORKS ASSN., Secy., Joseph C. Knox, 73 Tremont St., Boston 8, Mass.

1959

Jan. 22-23—New York, N. Y. *(Park-Sheraton Hotel)*
NEW YORK SEWAGE & INDUSTRIAL WASTES ASSN., Exec. Secy., Ralph C. Sweeney, State Dept. of Health, 55 Church St., White Plains, N. Y.

CONTINUED ON PAGE 102A



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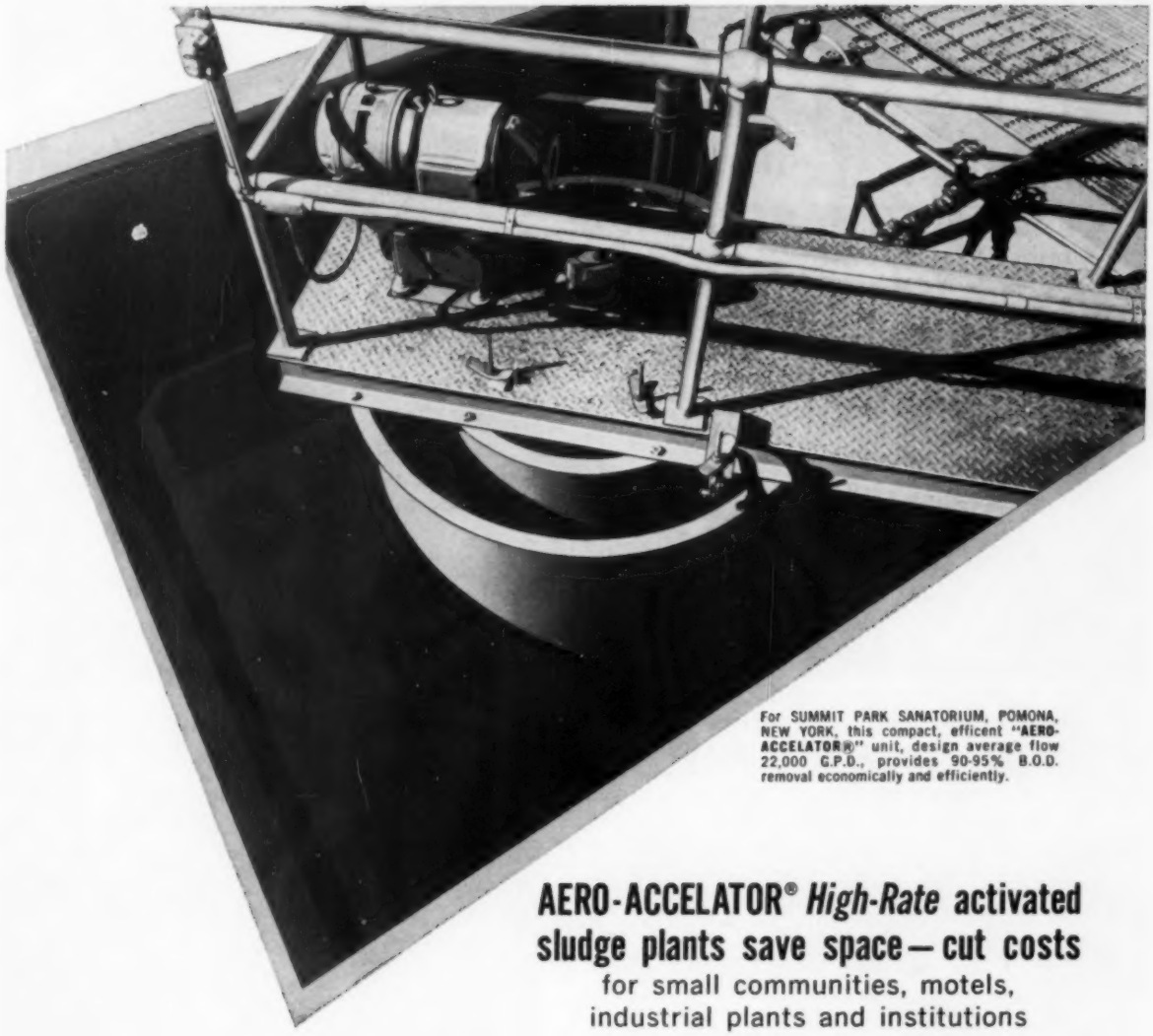

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9-30-54	7 AM-2 PM	20	264	9.2	96.5	117	7.7	93.4
10-25-54	8 AM-3 PM	25	321	24.0	92.5	301	16.6	94.5
10-30-54	8 AM-12 N	15	325	21.0	93.6	274	15.7	94.3
11-16-54	8 AM-3 PM	20	271	20.5	92.4	268	21.8	91.9
3- 4-55	7 AM-3 PM	20	169	14.0	91.7	125	11.0	91.2

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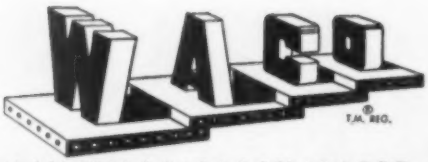

ALUMINUM WALKWAYS ARE SAFE, MAINTENANCE-FREE

Non-Corrosive, Strong and Durable—They are Valuable Assets in Water and Sewage Plants

George H. Hill, Washington Aluminum's New England representative, points out the grating's patented non-directional, non-skid safety feature.

Washington Aluminum Walkways *provide* a lifetime of maintenance-free service—never need painting, resist rust and corrosion, provide ventilation. Their strength lies in the I beam extrusion.

Washington Aluminum fabricates grating and other installations to specification. Washington Aluminum Engineers are available for discussion of design problems on any installation at point of planning. No obligation. **Write for nearest representative.**

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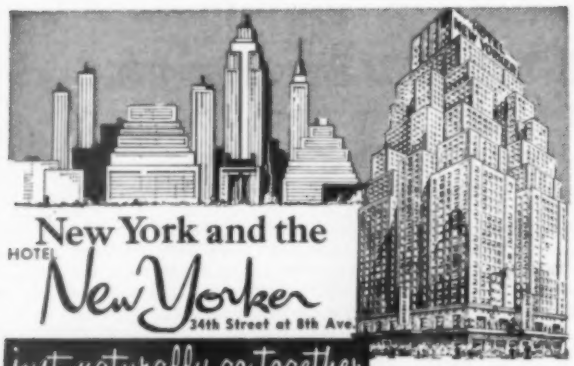

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PITTSBURGH, PA. Hotel Sherwyn
DENVER, COLO. Hotel Park Lane
NEW YORK CITY Hotel New Yorker

World famed hotels—Teletype service—Television

Feb. 4-6—Indianapolis, Ind. *(Sheraton Hotel)*
INDIANA SECTION, A.W.W.A., Secy., Chester H. Canham, State Bd. of Health, 1330 West Michigan St., Indianapolis 7, Ind.

Feb. 9-13—Los Angeles, Calif. *(Hotel Statler)*
AMERICAN SOCIETY OF CIVIL ENGINEERS, Exec. Secy., W. H. Wisely, 33 W. 39th Street, New York 18, N. Y.

Mar. 1-6—College Station, Texas *(A & M College)*
TEXAS WATER & SEWAGE WORKS ASSN., Annual Short School, Secy., V. M. Ehlers, 2202 Indian Trail, Austin 3, Texas.

Mar. 11-13—Chicago, Ill. *(Morrison Hotel)*
ILLINOIS SECTION, A.W.W.A., Secy., Dewey W. Johnson, Cast Iron Pipe Research Assn., Suite 3440 Prudential Plaza, Chicago 1, Ill.

Mar. 11-13—Atlantic City, N. J. *(Traymore Hotel)*
NEW JERSEY SEWAGE & INDUSTRIAL WASTES ASSN., Secy., Anthony T. Leahey, P. O. Box 32, West Trenton 8, N. J.

Mar. 16-18—Little Rock, Ark. *(Marion Hotel)*
ARKANSAS WATER & SEWAGE CONF., C. W. Oxford, Univ. of Arkansas, Fayetteville, Ark.

Apr. 2-3—Chapel Hill, N. C. *(Univ. of North Carolina)*
EIGHTH SOUTHERN MUNICIPAL & IND. WASTE CONF., Prof. Dan A. Okun, Univ. of North Carolina, Chapel Hill, N. C.

Apr. 5-8—Columbia, S. C. *(Wade-Hampton Hotel)*
SOUTHEASTERN SECTION, A.W.W.A., Secy., N. M. de Jarnette, State Dept. of Public Health, 309 State Office Bldg., Atlanta 3, Ga.

Apr. 8-10—Rochester, N. Y. *(Powers Hotel)*
N. Y. SECTION, A.W.W.A., Secy., Kimball Blanchard, 19 W. 50th St., New York 20, N. Y.

Apr. 9-11—Glendive, Mont. *(Jordan Hotel)*
MONTANA SECTION, A.W.W.A., AND MONTANA SEWAGE & INDUSTRIAL WASTES ASSN., Joint Meeting, Secy., Arthur W. Clarkson, State Board of Health, Helena, Mont.

Apr. 15-17—Lincoln, Neb. *(Cornhusker Hotel)*
NEBRASKA SECTION, A.W.W.A., Secy., Rupert C. Ott, Jr., Neptune Meter Co., 2818 - 21st St., Columbus, Nebr.

Apr. 16-18—Phoenix, Ariz. *(Westward Ho Hotel)*
ARIZONA SECTION, A.W.W.A., Secy., Stanford I. Roth, Div. of Water & Sewers, Phoenix, Ariz.

Apr. 22-24—Hutchinson, Kansas *(Baker Hotel)*
KANSAS SECTION, A.W.W.A., Secy., Harry W. Badley, Neptune Meter Co., 119 West Cloud, Salina, Kan.
(Jointly With)
KANSAS SEWAGE & INDUSTRIAL WASTES ASSN., Secy., James F. Aiken, Jr., 1900 East Ninth, Wichita, Kan.

Apr. 29-May 2—Long Beach, Calif. *(Hotel LaFayette)*
CALIFORNIA SEWAGE & INDUSTRIAL WASTES ASSN., Secy., Alfred Leipzig, 12000 Vista Del Mar, Venice, Calif.

May 3-6—Montreal, Can. *(Hotel not listed)*
CANADIAN SECTION, A.W.W.A., Secy., Dr. A. E. Berry, 72 Grenville St., Toronto, Ont., Can.

May 5-7—Lafayette, Ind. *(Purdue University)*
14TH PURDUE INDUSTRIAL WASTE CONF., Chairman, Prof. Don E. Bloodgood, Purdue University, Lafayette, Ind.

May 4-8—Cleveland, Ohio *(Hotel Cleveland)*
AMERICAN SOCIETY OF CIVIL ENGINEERS, Exec. Secy., W. H. Wisely, 33 W. 39th Street, New York 18, N. Y.

June 4-6—Tuscaloosa, Ala. *(Univ. of Alabama)*
ALABAMA WATER & SEWAGE ASSN., Secy., E. J. Finnell, Jr., University of Alabama, University, Ala.

MR. K. F. KNOWLTON, Superintendent of Salem-Beverly, Mass. Water Filtration Plant, explains why:

"This filter bottom needs no maintenance, even after 5 years of operation"

"Our plant was built originally to handle 8 MGD, with conventional perforated cast iron laterals, and 18" of graded gravel supporting 30" of sand. Back in 1953 we installed these ALOXITE® aluminum oxide porous plates to get rid of the problem of shifting gravel layers. By 1955, the results had proved to be so good that we've been adding more porous bottoms every year.

"For one thing, we don't have to worry now about gravel beds being upset, or cleaning out mudballs. It's also very easy to move away the sand above ALOXITE plates so we can inspect the hold-down bolts or any part of the bottoms. It's easy to clean the filter, too. We use a minimum of washwater, and of course there's no more mixing of graded gravel and sand.

"Next, these porous plates have stood up well under rates of filtration far greater than the 8 MGD the plant was built to handle. One day this past summer, for example, we ran almost 15 MGD. During July and August, average daily consumption was over 10 MGD.

"Finally, these ALOXITE filters were the least expensive and most easily installed type of bottom for our existing structure. We were very careful about the installation—and this care has paid dividends in the excellent condition of the porous plates, the hold-down bolts, and the joints between the plates."

CARBORUNDUM

Registered Trade Mark

Dept. X-128, Refractories Division, Perth Amboy, N. J.

News of Suppliers

American Cynamid Promotes Lowery

American Cyanamid Co., New York, N. Y., has announced that Joseph D. Lowery has been appointed assistant general sales manager of the Industrial Chemicals Division.

A veteran of 36 years with Cyanamid, Mr. Lowery was formerly the manager of the company's Heavy Chemicals Department. He has also held a variety of executive sales and administrative posts with the company.

Rockwell Appoints District Sales Managers

Rockwell Mfg. Co., Pittsburgh, Pa., has announced the appointments of John G. Hoyt Jr., and William H. Henry as Southeast and Southwest district sales managers respectively, for the company's Municipal and Utility Division.

Formerly, Southeast district sales manager for the Meter and Valve Division, Mr. Hoyt will supervise all water and parking meter sales operations in the area from the Atlanta, Ga., district office.

Mr. Hoyt, upon his new appointment, announced that James B. Brown has joined the company, and will handle water meter sales in the Florida area.

Mr. Henry, formerly Southwest district sales supervisor for the Meter and Valve Division, will direct all water and parking meter sales operation in the Southwest area from the Houston district office.

Ernest J. Bradley, has joined the Southwest district as a sales engineer handling water and parking meter sales in the Louisiana area, according to the announcement made by Mr. Henry upon his new appointment.

Chicago Bridge Assigns Two Sales Engineers

Chicago Bridge & Iron Co., Chicago, Ill., has assigned two engineers to company sales offices in Chicago and Kansas City, Missouri.

Harry G. Pazucha, formerly of CB&I's general sales department, has joined the Chicago sales staff. He has been with CB&I since 1952 and holds a B.S. degree from Illinois Institute of Technology.

Richard J. Bassett has been transferred from the Salt Lake City Plant to the Kansas City sales office. He joined CB&I in 1954, shortly after his graduation from the University of Utah with a B.S. degree in Civil Engineering.

Infilco Promotes Three

Infilco, Inc., Tucson, Arizona, has announced that C. T. VanderMolen has been appointed to the position of Assistant Sales Manager with direct supervision of the activities of the Sales Engineering Department of the Company. With a background of 28 years with Infilco, including 10 years in Sales and Management capacities, Mr. VanderMolen brings a wealth of experience and an extremely successful record to his new position.

H. W. Frazer, formerly Manager of the Demineralization Division, has been promoted to the new position of Industrial Project Manager. In this capacity, he will have supervision of the sales engineering and project activities of the Industrial Water, Industrial Waste, Demineralization, Metallurgical, Pulp and Paper and Beverage Divisions of the Company.

A new Project Engineering Department has been organized to provide additional facilities for customer service as a result of the expanding activities of the company. The new Department will be under the direction of Mr. L. H. Piper, for many years, head of the Estimating Department. It will provide assistance to both the Sales Engineering and Production Engineering Departments on the technical aspects and scheduling of projects, including contact with customers and their engineers and contractors.

CONTINUED ON PAGE 106A

STATEMENT OF OWNERSHIP

Statement required by the Act of August 24, 1912, as amended by the Acts of March 3, 1933, and July 2, 1946 (Title 39, United States Code, Section 233) showing the ownership, management and circulation of

Water & Sewage Works

published 13 times yearly at Pontiac, Illinois, for November, 1958.

1. The names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Edward Scranton Gillette, 185 North Wabash Ave., Chicago 1, Illinois; Editor, Dr. George E. Symons, 155 East 44th Street, New York 17, N. Y.

2. The owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual member, must be given.) Scranton Publishing Co., Inc., 185 North Wabash Ave., Chicago 1, Ill.; Edward S. Gillette, 185 North Wabash Ave., Chicago 1, Ill.; Claribel T. Gillette, 185 North Wabash Ave., Chicago 1, Ill.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: None.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

Edward S. Gillette, Publisher

Sworn to and subscribed before me this 26th day of September, 1958. Helen Buford Hoppe, Notary Public. (My commission expires March 19, 1960.)

6,600 reasons why Greensburg depends on Bailey!

Every day the 6,600 residents of Greensburg, Indiana, use up to 1,000,000 gallons of water. Three Bailey Filter Operating Consoles control and indicate the flow of this water through the rapid sand filters. Space for a fourth console has been provided for future expansion.

Engineers: Moore & Heger

With population growth and industrial expansion comes the opportunity to adopt newer, more economical and more scientific methods of water handling.

Many cities, like Greensburg, are installing Bailey Instrument and Control Systems. Because Bailey can furnish *complete* control systems... made up of *standardized* components... that not only do a better job, but can easily be *expanded* to meet future needs. Engineers, water superintendents and city officials themselves will tell you that Bailey electric and pneumatic telemetering and control systems are outstandingly reliable and economical, attractive, and easy to maintain.

Ask your qualified Bailey Engineer for recommendations.

W-5

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In Canada—Bailey Meter Company Limited, Montreal

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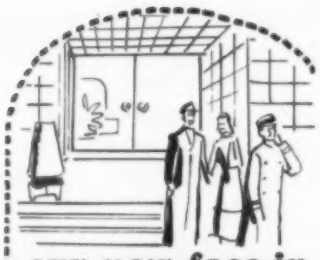

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Harry E. Paulsen, General Manager
FACING GRAND CIRCUS PARK

DETROIT

News of Suppliers

CONTINUED FROM PAGE 104A

Byers Appoints 4 Distributors

A. M. Byers Company, Pittsburgh, Pa., has announced the appointment of four new distributors.

They are Jones-Sylar Supply Company, Inc., Chattanooga, Tennessee; Independent Plumbing Supply, Dorchester, Massachusetts; Corbra Pipe & Coil, Elmwood, Connecticut; and Roberts Supply Company, Omaha, Nebraska.

These distributors are marketing new 4-D wrought iron pipe in cooperation with Byers various regional offices.

Chicago Bridge Expands Two Plants

Chicago Bridge & Iron Co., Chicago, Ill., has announced plans for the addition of new facilities to its Greenville, Pa., and Salt Lake City plants.

A 100-foot by 400-foot building for structural fabrication and two open crane runways will be built at Greenville. The runways, 100 feet by 400 feet and 93 feet by 400 feet respectively, will be used for structural receiving and shipping.

At Salt Lake City, CB&I will erect a 100-foot by 400-foot building of light construction, which will be equipped with five-ton cranes, for the fabrication of small details parts, fittings, accessories and structural steel.

The company also has announced completion of an addition to its Salt Lake City office building, which has provided 11,800 square feet of working space for product engineering, shop supervision, industrial engineering, automatic machine accounting and first aid facilities.

Worthington Changes Trademark

Worthington Corp., Harrison, N. J., has announced that as part of a complete streamlining of this company a new trademark has been adopted. This bold new trademark will replace the old winged trademark that has served the company for the past 73 years.

The adoption of the new trademark follows by six years the abandonment of "Worthington Pump and Machinery Corporation" company name in favor of "Worthington Corporation."

Research of the old trademark, including a poll of more than 200 mechanical engineers, indicated that the wings of the ancient Eyptian scarab trademark was not connected with the company. Thus, a new bold, prominent trademark, symbolic of a modern, vigorous and friendly company, was selected.

The changeover will be rapid, and probably the most prominent visual display of the old trademark, the immense sign on the Harrison Plant facing the Pennsylvania Railroad tracks, will be replaced by the new mark.

Hays Co. Expands Plant

Hays Manufacturing Co., Erie, Pa., as a further step in its expansion program, is now occupying a recently acquired addition to its plant. The new quarters comprise 115,000 square feet of modern factory and office space, and are adjacent to the original buildings.

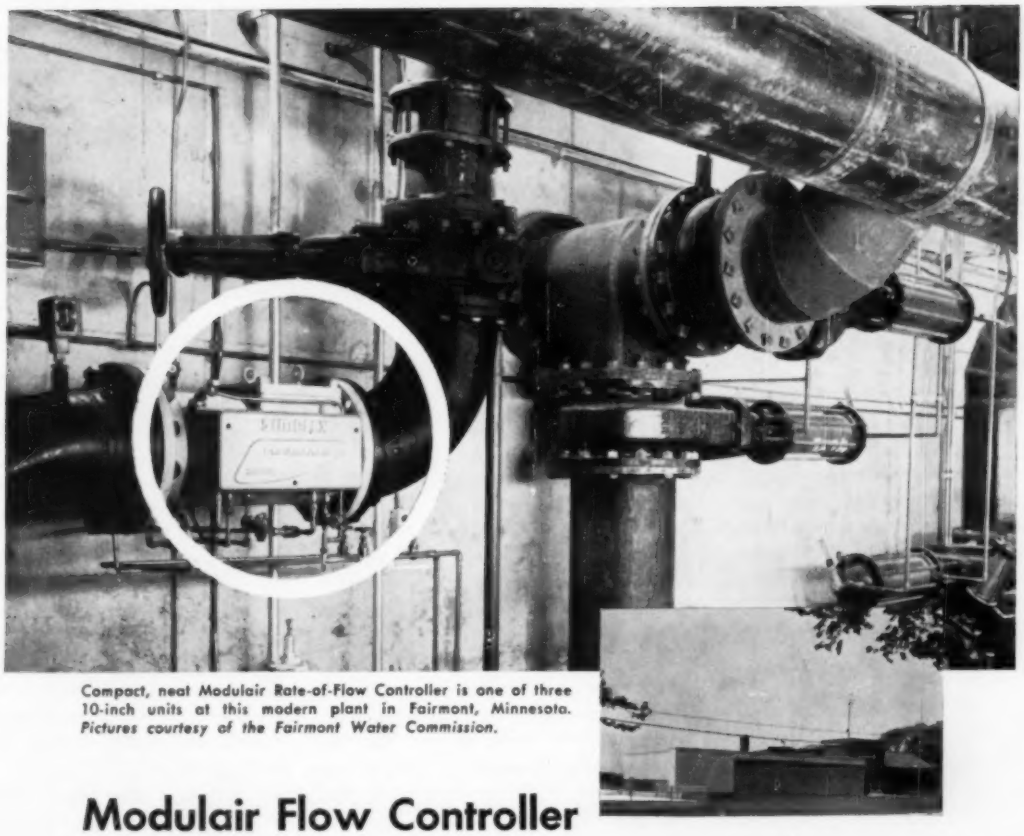
The machining, assembly, testing, and shipping departments have already been moved to new quarters. The increased space allows more efficient planning and streamlining of operations. Modern precision machines and statistical quality control testing assure the highest possible quality products.

Hersey Promotes Snellgrove

Hersey Mfg. Co., Dedham, Mass., has announced that John H. Snellgrove has been named assistant to the sales manager.

Along with his new duties he has assumed charge of the water meter manufacturing firm's new Contract Division.

A native of Elgin, Ill., Mr. Snellgrove attended Illinois Institute of Technology and served with the USMC in World War II. He started in Hersey's Chicago office five years ago, transferred to the West Coast as sales engineer and last year moved to the Dedham, Mass., Headquarters.



Compact, neat Modulair Rate-of-Flow Controller is one of three 10-inch units at this modern plant in Fairmont, Minnesota. *Pictures courtesy of the Fairmont Water Commission.*

Modulair Flow Controller installs as easily as a piece of pipe

So simple is this new pneumatic rate-of-flow controller you can install it in about the time it takes to plumb a piece of pipe.

The differential producer and the modulator are housed in a single casting. The actuator is entirely enclosed in a case which mounts directly on this pipe section.

There's no complicated piping or drain system to install. The Modulair comes direct from the factory as a completed unit.

Low first cost. This simplicity of design makes an *installed* Modulair about the lowest cost flow controller around.

Low maintenance too. There are no moving parts in the line other than the modulator and nothing to wear out but the actuator. No stuffing boxes. Maintenance is practically nil.

How Modulair works. Under flow conditions, the venturi section sets up a differential pressure which causes the diaphragm to position a counterweighted beam. The beam controls a variable pneumatic output pressure against a rubber modulator beyond the piezometer ring of the venturi . . . assures positive control of the flow rate.

Send for bulletin. The whole Modulair story is told concisely in Bulletin 951. Write for a copy.

SIMPLEX

VALVE AND METER COMPANY

a subsidiary of PFAUDLER PERMUTIT INC.

LANCASTER, PENNSYLVANIA

New Bulletins

CONTINUED FROM PAGE 40A

Liquid Ion Exchanger

1127

Resinous Products Div., Rohm & Haas Co., Philadelphia, Pa., has released a new 17-page booklet of technical notes on Amberlite LA-1, liquid amine anion exchange resin. The nature and properties of this liquid ion exchanger are discussed, followed by details in the handling and operational steps in using this product.

Application studies of Amberlite LA-1 in hydrometallurgy, for the extraction of uranium, thorium, vanadium, and rare earths are presented. Recovery and separation processes, as suggested practices with this commercially available exchanger, include special separation processes, purification of process streams, and pollution control.

Prefabricated Underground Pumping Stations

1128

Zimmer & Francescon, Moline, Ill., has available an 8-page bulletin describing the completely prefabricated Z-F Underground Pumping Station.

The bulletin presents the automatic operating features, and simple installation requirements of the stations for sub-divisions, industrial sites, where extensions to sewer systems require that the flow be raised to the level of existing mains, and other projects.

Complete specifications are given, and the bulletin points out that the units are shipped to the job site ready for installation.

Multiple Stage Flow Test Panel

1129

Fischer & Porter Co., Hatboro, Pa., has just published a technical bulletin describing the company's Test Panel.

According to the bulletin, the panel consists of a four-stage group of high accuracy, low flow variable-area flowmeters piped together with appropriate valving to give over 600 to 1 range of flow indications.

Communication and Control Systems

1130

Femco, Inc., Irwin, Pa., has announced the publication of six illustrated one-page buletins featuring new Femco control and communication systems. Under the heading "Femco Firsts," the bulletins represent the beginning of a complete series of new product announcements to keep industrial buyers informed. Among the "Femco Firsts" now available are "Remote Control for Natural Gas Systems," "Femco Control for Water Systems," "Mine Power Controlled by Fan Operation," and "Loudspeaking Telephones."

Rotary Blowers and Pumps

1131

Sutorbilt Corp., Compton, Calif., a subsidiary of the Fuller Co., Catasauqua, Pa., has just released a 20-page, 2-color bulletin giving full details on continuous-service rotary positive pressure blowers, gas and vacuum pumps.

The new bulletin contains photographs and cutaway drawings on all the blowers and gas pumps, showing their construction in detail. The line is designed to handle volumes of air or gas from 1,000 up to 20,000 cfm. and pressures and vacuums up to 10 psig single stage. Double stage units can be provided for applications involving higher pressures.

A section of the bulletin explains operating principles and a list of 24 applications shows typical uses. Thirteen installation views show various blowers and pumps in use.

Tank and Structure Maintenance

1132

Steel and Tank Service Co., Charlotte, N. C., has available a report on Stetsco Service.

The booklet discusses and illustrates the many complete services offered by the company for the care and maintenance of any type of storage tank and most any type of steel structure. Some of the services covered in the booklet are: inspection, cleaning, repairing, painting, metallizing and special coatings.

Photographs illustrate each phase of the service and present before and after evidence.

Recording Turbidmeter

1133

General Electric Co., Schenectady, N. Y., has just published a bulletin describing the General Electric recording turbidmeter which is used to continuously monitor the turbidity or cloudiness of fluids. Applications, principles of operations and specifications are listed. Block diagram shows the solids—removal operation in a typical water treatment plant.

Radial Duafuel Engines

1134

Nordberg Mfg. Co., Milwaukee, Wis., has just released a 16-page bulletin describing Nordberg Radial engines, two-cycle Diesel, spark-ignition gas and Duafuel.

The newly revised two color bulletin, describes recent engineering and design features which includes supercharging of the spark ignition Radial engines for an increase in rating of approximately 50% over normally scavenged engines. A schematic drawing helps to describe the relatively minor and simple modifications required to change from a normally scavenged to a supercharged engine. Installation photos include a view of part of the world's largest internal combustion engine plant where a total of 475,000 horsepower is produced with 220 normally scavenged and 22 supercharged Nordberg Radial engines.

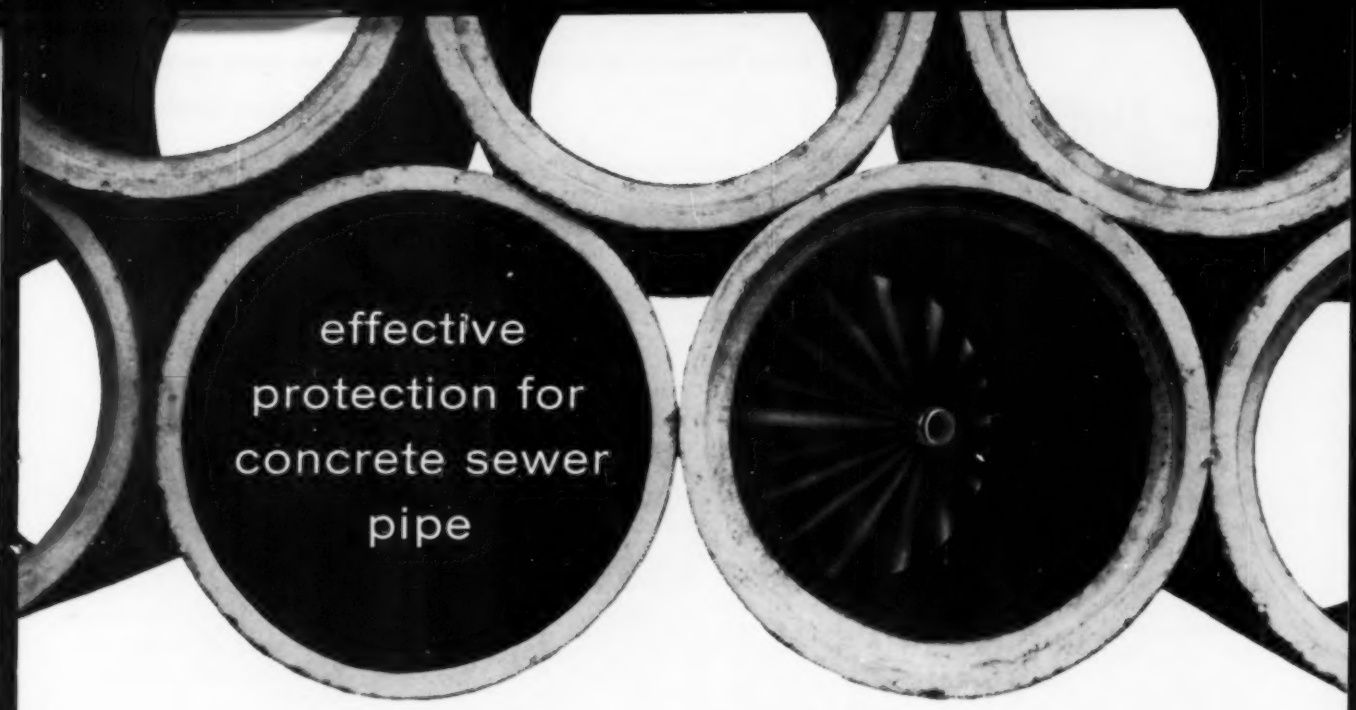
The new bulletin describes the space saving features of Nordberg Radial engines. Schematic drawings vividly show the simple foundation and minimum building requirements when installing ac generators, vertical water pump plants and vetical centrifugal pump drives. The versatility of Nordberg Radial engines is quickly noted for these and similar applications. Cut-away photographs and line drawings clearly show the inner workings and detailed assembly of Radial engines.

Rotameters For Large Pipelines

1135

Schutte and Koerting Co., Cornwells Heights, Pa., has just published a new bulletin that describes the company's line of Bypass Rotameters for measuring fluid rate of flow in pipe-

CONTINUED ON PAGE 110A



Easily applied internal coatings of Copon Arocoat prevent pipe deterioration caused by sewage products

Now, you can easily prepare concrete pipe for sewage applications. For internal coatings of Copon Arocoat can be quickly, economically applied with spray equipment . . . provide positive, permanent protection against the destructive action of hydrogen sulfide and other chemicals present in sewage.

A combination of epoxy and coal tar resins, Copon Arocoat coatings have been used to solve many of industry's toughest corrosion problems. Underground, they remain tough and elastic despite temperature extremes . . . do not deterioriate. Other successful pipe applications include submerged, buried and exposed transmission lines.

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FOR CORROSION CONTROL

New Bulletins

CONTINUED FROM PAGE 108A

lines 2 inches in diameter and larger.

According to the bulletin the rotameters installation is described as comprising an orifice in the main pipeline, and a ½-inch and or 1-inch diameter bypass line across the orifice containing a small orifice and an SK Safeguard Rotameter of indicating, alarm, or transmitting type. The two Orifices make the bypass flow directly proportional to the main pipeline flow, and the Rotameter is calibrated to read the main flow directly.

The Bulletin also presents simplified, easy-to-follow instructions for determining the permanent pressure loss across the main orifice, and the required straight run of pipe before and after the main orifice.

Desanding System

1136

Dorr-Oliver, Inc., Stamford, Conn., has announced the availability of a new four-page, two-color bulletin entitled, "The DorrClone Desanding System." This bulletin describes the design, operation and performance of this new system for desanding water supplies. Also included in the bulletin are an installation photograph, schematic flowsheet of the system, cutaway wash drawing of the DorrClone classifier and operating data.

According to the bulletin the DorrClone Desanding System is designed to provide an inexpensive method of continuously eliminating highly abrasive fine sand and silt from distribution systems. Principal component of the system is the DorrClone classifier, a wet cyclone widely used in other industries for liquids-solids separations.

Sewage Sludge Disposal

1137

Combustion Engineering, Inc., Chicago, Ill., has available a 28-page, 2-color booklet in the C-E Raymond Flash Drying and Incineration System for Sewage Sludge Disposal.

Profusely illustrated the booklet presents case histories on a number of installations, and covers in detail, sludge preparation, flash drying and sludge utilization, dual disposal of refuse and sludge, incineration, deodorization, dust collection and authentic controls and instruments.

Multi-colored operations drawings are shown illustrating each step in the processes. The center pages present in tabular form, complete design data covering 40 different installations.

Also included in the booklet is a discussion on the use of sewage sludge as a soil conditioner.

Rotary Blowers

1138

Roots-Connersville Blower, Div. of Dresser Industries, Inc., Connersville, Ind., has just issued a new, revised edition of a bulletin covering R-C Type AF rotary positive blowers. The 8-page bulletin has been brought completely up-to-date to include new capacities and pressure ratings. Detailed design and construction information is presented together with all essential application of this equipment in a wide range of process industries, for either vacuum or pressure.

Automtaion Equipment and Instruments

1139

B-I-F Industries, Inc., Providence, R. I., has published a new 8-page, 2-color bulletin that describes representative items from the company's wide line of process instrumentation and equipment. The bulletin contains photographs, operational data, and design feature description of twelve varied products for positive control of materials in motion.

Some of the items described are: a new, lightweight, plastic insert-type Dall Flow Tube for metering water, gases, slurries and corrosive fluids; Low head-loss, accurate Venturi Tubes for main line metering of water, sewage, and other fluids; the Venturi Flow nozzle for high pressure fluid metering; Venturi Insert Nozzles especially suited for low-cost metering; Chronoflo Telemeters for remote metering and control of distant process variables and equipment; transistorized Synchro-Scan Systems for multi-function central supervisory control of far-flung industrial processes, pipelines, and similar operations.

Vibrating Feeders Catalog

1140

Syntron Co., Homer City, Pa., has announced publication of a new 30-page catalog on their standard and special model electromagnetic vibrating feeders for hard-to-handle bulk materials.

Amply illustrated booklet contains complete descriptions, data and specifications for Syntron's complete line of 13 standard electromagnet vibratory feeders; three standard air, oil or water powered vibratory feeders for explosive materials, or dangerous atmospheres; special model Spreader Feeders; "heat-resistant" Furnace Feeders, Dryer, Preheater and Cooling Feeders, Picking tables, Conveyor Feeders, and Spiral Elevator Feeders.

Booklet also shows typical installations and a variety of application diagrams.

Centrifugal Pumps

1141

Goulds Pumps, Inc., Seneca Falls, N. Y., has just issued a bulletin describing their line of single stage double suction centrifugal pumps with horizontally split cases. The bulletin states that in addition to the wide range of capacities and pressures, a high degree of standardization and interchangeability of parts distinguishes these pumps. This means minimum inventory of spare parts, flexibility of changes in the field to meet new requirements and low initial cost.

This 16-page bulletin includes a general description of the pumps, specifications, sectional views, charts showing materials of construction parts list and parts interchangeability, construction details, mechanical data, performance curves and dimensional data.

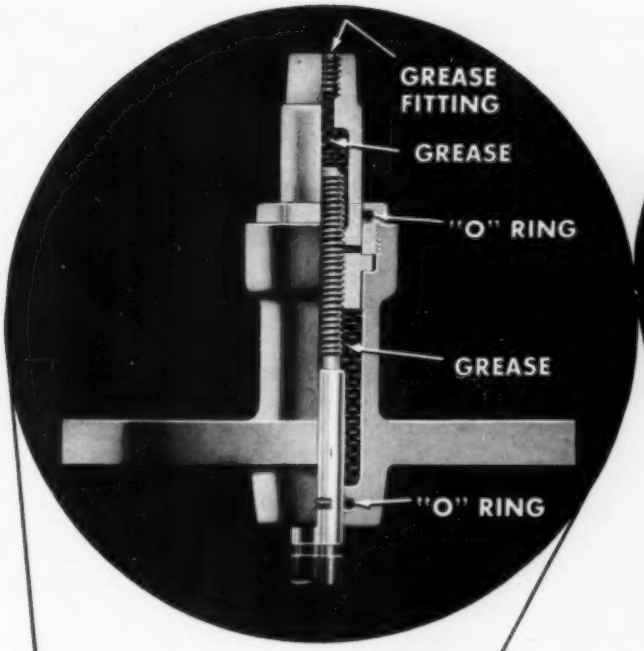
Flow Water Engineering

1142

The Foxboro Company, Foxboro, Mass., has announced the publication of the eighth edition of Principles and Practice of Flow Meter Engineering by L. K. Spink. Added are the latest developments in flow measurement, making the new text the largest, most complete and authoritative book to be published on flow meter engineering.

The hard-bound edition, primarily a text book, covers a much broader

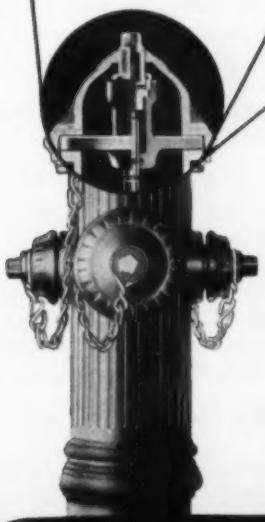
CONTINUED ON PAGE 112A



NEW DOUBLE FEATURE

SMITH[48] HYDRANTS

WITH "O" RING-SEAL AND GREASE CHAMBER FOR OPERATING THREADS



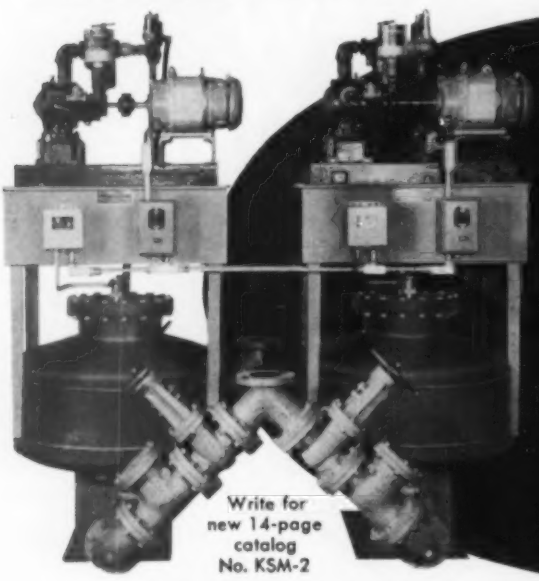
When you specify "O" Ring Seals rather than conventional packing you reduce maintenance to a minimum. The lower "O" Ring is the pressure seal, the upper "O" Ring the dirt seal. The initial compression of the "O" Rings provides the seal when the hydrant is closed. When subject to water pressure the lower "O" Ring is forced to the top of the groove. The sealing force increases as the pressure increases. The specially compounded rubber plastic "O" Rings insure a long life pressure seal. Each time the hydrant is operated, the "O" Ring Seals, the bearing surfaces, and the operating threads are automatically lubricated. Threads and upper section of the stem are continuously lubricated and sealed from contact with water in the standpipe. The lubricant is suitable for temperatures of minus 30 degrees to 200 degrees. All Smith Hydrants including hydrants in service can be fitted with "O" Ring Seal Plates.

FIRE HYDRANTS · VALVES · SINCE 1896 ·

THE A.P. SMITH MFG. CO.

EAST ORANGE, NEW JERSEY

K-S PNEUMATIC SEWAGE EJECTORS . .
. . SERVICE *backed by* EXPERIENCE



Komline-Sanderson experience, gained in the design, manufacture and installation of sewage handling equipment, guarantees the service offered with each K-S Sewage Ejector System. Sizes from 30 to 600 GPM capacities—single or duplex units. Construction—cast iron or steel. Pneumatic or electrode controlled.

Write for new 14-page catalog No. KSM-2

MECHANICAL EQUIPMENT DIVISION
KOMLINE-SANDERSON ENGINEERING CORPORATION
102 Holland Avenue, Peapack, New Jersey

GUNITE does it **2** times as fast at **1/2** the cost

"Gunite" is the modern process (sand and cement applied pneumatically) for repairing, constructing, lining:

- Reservoirs
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- Filter Plants
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FLORENCE, ALA. 1555 Helton Street

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NEWARK 5, N. J. 193 Emmet Street

New Bulletins

CONTINUED FROM PAGE 110A

scope than earlier editions, yet is conveniently arranged and indexed as a handbook for every-day one-source reference in commercial flow measurement.

The 549-page informative text, available at $15.00 per copy, covers the entire field of flow measurement, including such subjects as the history of developments in flow-metering, the theory of flow meters, the use and installation of primary devices, meter mechanisms, and liquid, steam and gas flow measuring practices. Representing over thirty years of cumulative research and experience, the latest edition uses current AGA and ASME terminology, with all tables, curves, factors, etc. based on AGA Report Number 3.

The author, L. K. Spink, spent a lifetime specializing on flow measurement, and from his early work with the American Gas Association on orifice coefficients to his duties as a member of the committee which prepared AGA Report Number 3, was a recognized authority on all phases of flow technology.

Priced at $15 per copy, Principles and Practice of Flow Meter Engineering is an up-to-date practical flow measurement authority for industrial and academic work.

Circular Slide Rule

1143

General Industrial Co., Chicago, Ill., has just introduced a handy circular Slide Rule for engineers and for other plant and office executives. Any executive who must perform simple calculations will find this convenient, pocket-size calculator extremely useful in his work.

Bellows Flow Meter

1144

Minneapolis - Honeywell Regulator Co., Industrial Div., Philadelphia, Pa., has just published a specification sheet that describes in detail the construction and operation of the Honeywell Bellows Meter for flow and liquid level applications. Included are features, specifications, and options.

CONTINUED ON PAGE 114A

Sir, Intelligence reports they just started using PITTCHLOR.® Our forces are in full retreat!

Better check your spy network, boys. It's no big secret that Pittchlor—a quick release granular form of chlorine—is being used in more and more water and sewage works to eliminate virtually every condition caused by chlorine susceptible bacteria. No wonder your forces—what's left of them—are in full retreat!

Columbia-Southern Pittchlor's 70% available chlorine makes it ideally suited to a wide range of sanitation uses. Its uniform, high quality chemical content retains stability wonderfully well both at work and in storage. You are always assured of chlorine in effective strength.

Many water and sewage works engineers prefer to use Columbia-Southern's Pittabs.® The tablet form of Pittchlor, Pittabs are identical in all chemical characteristics. You'll find these high test calcium hypochlorites effective in meeting your changing needs for immediate or continuous chlorination.

Won't you contact your nearest Columbia-Southern distributor *today*, to be sure of an adequate Pittabs and Pittchlor supply?

The Columbia-Southern Chemical Corporation, One Gateway Center, Pittsburgh 22, Pennsylvania. Offices in principal cities. In Canada: Standard Chemical Limited.

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A Subsidiary of Pittsburgh Plate Glass Company

PITTABS—Packaged in resealable cans, 7½ lb. (6 per case) and 3 lb. (5 per case). Also in 100 lb. drums.

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New Bulletins

CONTINUED FROM PAGE 112A

Separators and Thickeners

1145

Chain Belt Co., Milwaukee, Wis., has just published a bulletin on the Rex Foat-Treat Separators and Thickeners.

Instant Antifoams

1146

Hodag Chemical Corp., Chicago, Ill., has available a 3-page information sheet and free samples of new Hodag Instant Antifoams. Hodag Instant Antifoams are available in many different formulations to suit specific requirements.

Flow Indicators for Direct Observation

1147

Schutte and Koerting Co., Bucks County, Pa., has just released a bulletin describing the company's line of Flow Indicators for pipeline installation to give positive visual indication of flow conditions.

Dissolved Oxygen Analyzer

1148

Beckman Process Instruments Div., Fullerton, Calif., has available a new four-page bulletin on the Beckman Model 70 Dissolved Oxygen Analyzer.

The Bulletin, a two-color illustrated brochure, gives comprehensive information on the Model 70 which has been designed for continuous, automatic analysis of dissolved oxygen in high purity water.

Automatic Water Control Valves

1149

Golden-Anderson Valve Specialty Company, Pittsburgh, Pa., has just published an 8-page bulletin describing nine different automatic water control valves and their uses.

Nomograph For Sizing Chemical Feeding Systems

1150

Milton Roy Co., Philadelphia, Pa., has developed and published a nomograph to assist design engineers determine the ideal capacities for the controlled volume pump and the chemical holding tank.

Selecting Dall Tubes, Venturi Tubes and Nozzles

1151

Builders-Providence, Inc., a div. of B-I-F Industries, Inc., Providence, R. I., has published a technical bulletin that users of Dall Flow Tubes, Venturi Tubes and Venturi Nozzles for the metering of all fluids will find helpful when they are faced with the problems of selecting the proper throat size and calculating the head loss in various applications.

CONTINUED ON PAGE 116A

ALGAE-FREE WATER
MEANS
Copper Sulfate
treated water
Not only is Triangle Brand Copper Sulfate successful in controlling algae but it also is effective in killing some aquatic weeds. Since the weeds are submerged and disintegrated, there is no chance of them floating down stream to start new infestations, or to clog the waterway.
In sewage systems, Triangle Brand Copper Sulfate prevents roots and fungus from clogging pipes. However, there is no danger of affecting the surface trees owing to the low concentration of copper sulfate necessary to be valuable.
The new booklets "The Use of Copper Sulfate in The Control of Microscopic Organisms" and "Copper Sulfate for Root and Fungus Control in Sanitary Sewers and Storm Drains" will keep you up to date. Send for a copy today! Phelps Dodge Refining Corp., 300 Park Ave., New York 22, N. Y.
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Awaits Manufacturers Representative with good following among Sewage Treatment Plants and Consulting Engineers. Furnish experience, lines carried and territory actively covered.

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185 N. Wabash Ave., Chicago 1, Illinois

SAVE

on engineering costs
on construction costs
on maintenance costs

WITH THE NEW FLOmatcher MODEL B

one of 5 packaged Model B Units will solve your pumping problems

Now offered in your choice of five packaged units, FLOmatcher is the answer to any sewage pumping problem. Units range from 1 to 200 h.p., or larger by special order.

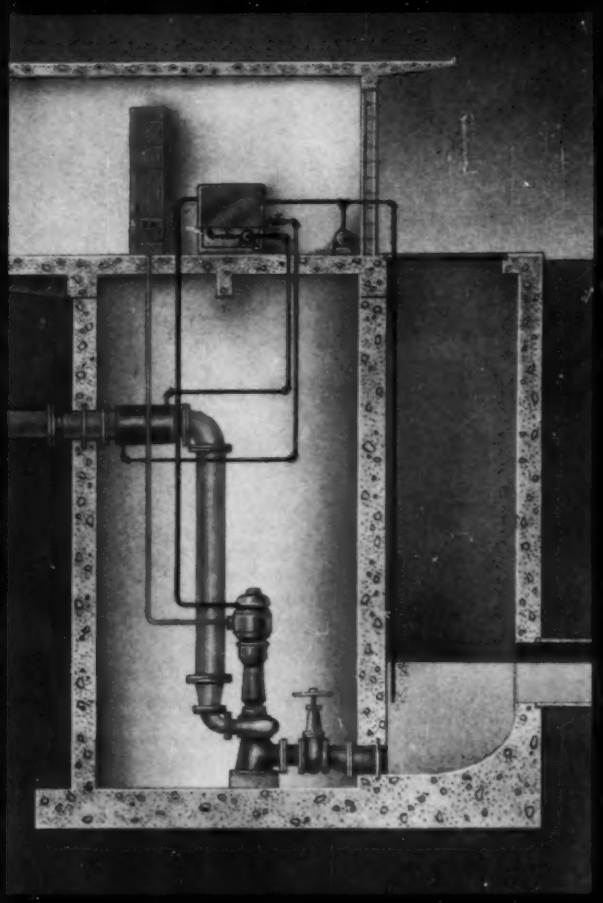
FLOmatcher Model B offers the same reliability, flexibility, stability, and long life as earlier FLOmatchers, plus the advantages of a thoroughly pre-engineered unit, remarkably simple to install, and far more accessible. FLOmatcher eliminates steps and surges, reduces the number of pumps necessary, and provides operating economy.

The new Model B utilizes a wound-rotor type pump driving motor, and a water rheostat assembly, as in earlier models, plus three new components; a compressed air supply, a heat exchanger and a bubbler tube.

The only regular maintenance necessary is the addition of a small amount of distilled water occasionally to make up for evaporation.

The FLOmatcher Model B is the most practical, dependable, and versatile pump rate control system available today. It will operate with equal success on pumps handling raw sewage or clear water. Write today to General Services Company for Bulletin #201.

ONLY GRAVITY MOVES SEWAGE SO WELL AS FLOmatcher



For full details on the FLOmatcher Model B Pump Control System, use Reader Service Card, or contact:

a product of
GENERAL SERVICES CO.

GENERAL SERVICES CO.
MARKETING DIVISION
P. O. Box 361 • Portland, Oregon • Phone: CA 2-1953

New Bulletins

CONTINUED FROM PAGE 114A

Pneumatic Transmission Lines

1152

Bailey Meter Co., Cleveland, Ohio, has just published a 4-page product specification describing Armortube Cable, a flexible, armored, multiple tube transmission line for pneumatic and hydraulic metering and control systems.

J-M Moulded Packings

1153

Johns-Manville, New York, N. Y., has just published a concise 12-page catalog on moulded packings that offers the type of information a designer wants to know about the selection and installation of sealing devices for pneumatic and hydraulic equipment.

Significance of the DEW LINE

In these days of war and rumors of war, America has just completed one of the greatest construction jobs in history—the 3,000-mile Distant Early Warning Line in the Arctic—called the "DEW" line. It is said to rank with the building of the Pyramids, the Great Wall of China, the Panama Canal, and the Burma Road. Its function is to give early notice to U. S. Military Defense Forces of the approach of enemy aircraft.

There is no way to know, of course, just what might become the U. S. target of enemy planes or intercontinental missiles. But let your imagination picture the result if an enemy could destroy a number of our water works distribution systems. In a short time, the Nation would be paralyzed.

The possibility emphasizes how much the American economy, yea our very civilization, depends upon our modern systems of water distribution. Your water system is buried underground—but don't forget it is there, nor how vital it is to your daily existence.

This Series is an attempt to put into words some appreciation of the water works men of the United States.

M&H VALVE AND FITTINGS COMPANY
ANNISTON, ALABAMA

SUBSIDIARY OF W WALWORTH

Sealed Register Water Meter

1154

The Municipal and Utilities Div. of Rockwell Mfg. Co., Pittsburgh, Pa., has just published a new, multi-color, 20-page catalog describing the Rockwell Sealed Register meter.

Condensation Prevention

1155

J. W. Mortell Co., Kankakee, Ill., has available a 32-page handbook that gives complete general and technical data on condensation and corrosion.

Benefits of Asbestos-Cement Pipe

1156

Keasbey & Mattison Company, Ambler, Pa., has just published a brochure which presents the advantages and features of asbestos-cement pipe and stresses the importance of "clear, full-flowing water—a community's most important asset!"

Motor Instruction Manual

1157

To help pump dealers and maintenance men to save time and needless procedures in installing, inspecting, and servicing its Verticlosed pump motors, U. S. Electrical Motors, Inc., Los Angeles, Calif., has just published a liberally illustrated and charted Instruction Manual covering both Verticlosed Type CFU, Oil-Lubricated, and Type SCU, Grease-Lubricated Motors. It outlines in careful, easy-to-understand steps various factory-developed procedures that are designed to minimize the dealer's and maintenance man's servicing efforts.

Residual Chlorine Analyzer

1158

Fischer & Porter Co., Hatboro, Pa., has just published a technical publication on their Residual Chlorine Analyzer, a double light beam filter photometer for continuous measurement of free, combined, or total residual chlorine in water or sewage.

Full description, technical details and specifications are also included.

Check Chart For Maintenance Painting

1159

The Wilbur & Williams Co., Brighton, Mass., has just issued the

CONTINUED ON PAGE 118A

MEMO TO MEN
ON THE WAY UP

WHERE THERE'S BUSINESS ACTION THERE'S A BUSINESSPAPER

Used to be a song, back in the Thirties, titled, *Little Man, You've Had a Busy Day.* Didn't mention the Big Man. But his days are busy, too. He's the man who must make top-level decisions in business. And to make those decisions, he must have facts. All the facts. All the pertinent information he can get.

He finds time, in his busy days, to get that information. How? By getting a major portion of it from one unique source: the business publications serving his particular field.

No businessman, Little or Big, is fully informed until he reads his businesspaper. He reads it for profit, not for pleasure. He searches it through for news of the trade or industry. For facts. For fresh ideas. For new products he can put to work. And he reads the advertising with the same intense concentration he devotes to the editorial pages.

For the man on his way toward becoming a Big Man, his businesspaper is especially important. Take a tip from the reading habits of key men at every level. Take out a subscription of your own. Then, make the time to read every issue—and read it thoroughly.

Water & Sewage Works

One of a series of advertisements prepared by THE ASSOCIATED BUSINESS PUBLICATIONS

See the 1958
WATER & SEWAGE WORKS
REFERENCE NUMBER

For the latest complete information

about **WATER SUPPLY**
and **SEWAGE DISPOSAL**

These industry leaders have interesting, informative messages in this great issue:

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Bethlehem Steel Company
B-I-F Industries, Inc.
Blackburn-Smith Mfg. Co., Inc.
Borden Metal Products Co.
Bremer Brease, Inc.
Builder-Providence, Inc., Div. of B-I-F Industries, Inc.
Chain Belt Company
Chicago Bridge & Iron Company
Chicago Pump Company
Climax Engine Co.
Clow, Jas. B. (Iowa Valve Co.)
Columbia Southern Chemical Div.
Combustion Engineering, Inc.
Cook Well Strainer Co.
DeZurik Corp.
Dorr-Oliver Inc.
Eimco Process Engineers, Inc.
Fine Organics, Inc.
Fischer & Porter Co.
Foster Engineering Co.
Frontier Chemical Co.
General Chemical Div. Allied Chemical Corp.
General Filter Co.
Golden Anderson Valve Specialty Co.
Graver Tank & Mfg. Co., Inc.
Graver Water Conditioning Co.
Hamilton Kent Mfg. Co.
Hardinge Company, Inc.
Infilco Inc.
International Minerals & Chemical Corp.
Iowa Valve Co.
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Johns-Manville
Jones Co., John Wiley
Komline-Sanderson Engineering Corp.
Link-Belt Company
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M & H Valve & Fittings Company
Merrick Scale Mfg. Co.
Multiplex Manufacturing Co.
Natco Corp.
National Clay Pipe Manufacturers, Inc.
National Power Rodding Corp.
Neptune Meter Co.
Nichols Engr. & Res. Corp.
Olin Mathieson Chemical Co.
Omega Machine Co., Div. of B-I-F Industries, Inc.
Pacific Flush Tank Co.
Pennsalt Chem. Corp. (West Div.)
Permutit Company
Phelps Dodge Refining Corp.
Philadelphia Quartz Co.
Phipps & Bird, Inc.
Pittsburgh-Des Moines Steel Co.
Pratt, Henry, Co.
Precision Chemical Co.
Preload, Inc.
Proportioneers, Inc., Div. of B-I-F Industries, Inc.
Rensselaer Valve Co.
Roberts Filter Mfg. Co.
Robinson Pipe Cleaning Co.
Schramm, Inc.
Shahmoon Industries, Inc.
Simplex Valve & Meter Co.
Smith-Blair, Inc.
Smith & Loveless, Inc.
Smith Mfg. Co., A. P.
Standard Steel Corp.
Tennessee Corporation
U. S. Pipe & Foundry Co.
Vulcan Materials Co.
Walker Process Equip. Inc.
Wallace & Tiernan, Inc.
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Water Seals, Inc.
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185 N. Wabash Ave., Chicago 1, Ill.
155 E. 44th St., New York 17, N. Y.

New Bulletins

CONTINUED FROM PAGE 116A

fourth edition of its famous Check Chart to bring up to date the latest technical recommendations on selecting the right paint for maintenance problems. Included in application recommendations are products based on many of the newest resins, such as Hypalon, Polyurethane and Saran, as well as rubber and vinyl combination.

Liquid Level Controls

1160

B/W Controller Corp., Birmingham, Mich., has released a new catalog describing the B/W system of Liquid Level Control which operates without floats and with no moving parts in the liquid. The catalog covers B/W liquid level relays, electrodes, signals, alarms, and alternators, with descriptions, charts and diagrams of typical applications. Panels for liquid level and industrial controls are also included.

The Heart of fine WATER PURIFICATION SYSTEMS

Roberts Mechanical Equipment

ROBERTS FILTER Mfg. Co.
607 COLUMBIA AVE.
DARBY, PA.

Magnetic and Motorized Valves

1161

The Mercoid Corp., Chicago, Ill., has just released a 24-page catalog that illustrates and lists specifications of magnetic and motorized valves for use with air, water, gas, steam, oil and refrigerants. Also included are solenoid coil rating tables.

Rubber Expansion Joints and Flexible Pipe

1162

General Rubber Corp., Tenafly, N. J., has just released a new 6-page, 2-color bulletin giving complete information on their new line of high quality Rubber Expansion Joints and Flexible Pipe.

Blowers For Vacuum Service

1163

Roots-Connersville Blower, Division of Dresser Industries, Inc., Connersville, Ind., has just published a new bulletin covering the complete line of cycloidal blowers for vaccum service. The bulletin presents detailed design and construction data as an aid to proper application of this equipment in a wide range of process industries.

Slip Joint Clay Pipe

1164

Robinson Clay Product Co., Akron, Ohio, has just released a completely new folder describing the company's Slip-Joint Clay Pipe. Designed for quick reference, this fully illustrated folder contains data on handling and installation of Robinson Slip-Joint Clay Pipe, with special emphasis on Slip-Joint fittings for all installation requirements.

Ion Exchange Regeneration

1165

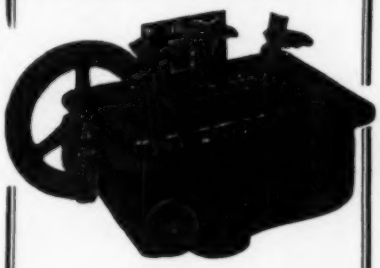
Graver Water Conditioning Co., New York, N. Y., has a new technical reprint on ten methods of ion exchange regeneration.

Automatic Valve Catalog

1166

Cash-Acme, Decatur, Ill., has available a twelve color-page condensed catalog containing information on 212 popular valves. Of these, 19 are entirely new and have never been catalogued before. Convenient specification tables make it an ideal source for quick valve selection. Tables included:

ROTO-TROL



RF-2

WITH ALTO-TROL

This 2-pump RF-2 Roto-Trol assures equal use and wear of both pumps. Each pump is operated on alternate starting cycles.

The RF-2 operates both pumps together, when required. RF-2 installations give dependable service year after year, with the minimum of attention.

Write for full data

WATER LEVEL CONTROLS DIVISION

HEALY-RUFF COMPANY

783 Hampden Ave., St. Paul 4, Minn.

ENSLOW

STABILITY INDICATOR

For checking the equilibrium of a finished water, and supplying an index useful in controlling anti-corrosion treatment. Catalog No. 83-895

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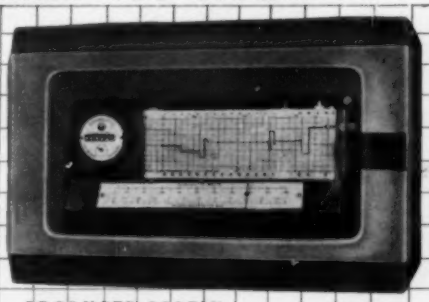
Phipps & Bird, Inc.

P. O. Box 2V Richmond 5, Va.

INSTALLATION, INSPECTION, READING — ALL SIMPLE WHEN YOU SPECIFY . . .

Sparling

RECORDING INSTRUMENTS



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All Sparling recording instruments, both strip and circular chart, were designed, developed and produced solely for water metering. Over a period of many years, a wide variety has been in use, meeting practically every measurement need. They are designed with flexibility in mind—for centralized or decentralized installations, telemetering or remote hook-up—electrical or cable controls.

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Company.....

Address.....

City.....Zone.....State.....

Send to: SPARLING METER COMPANY
229 N. Temple City Blvd., EL MONTE, CALIFORNIA

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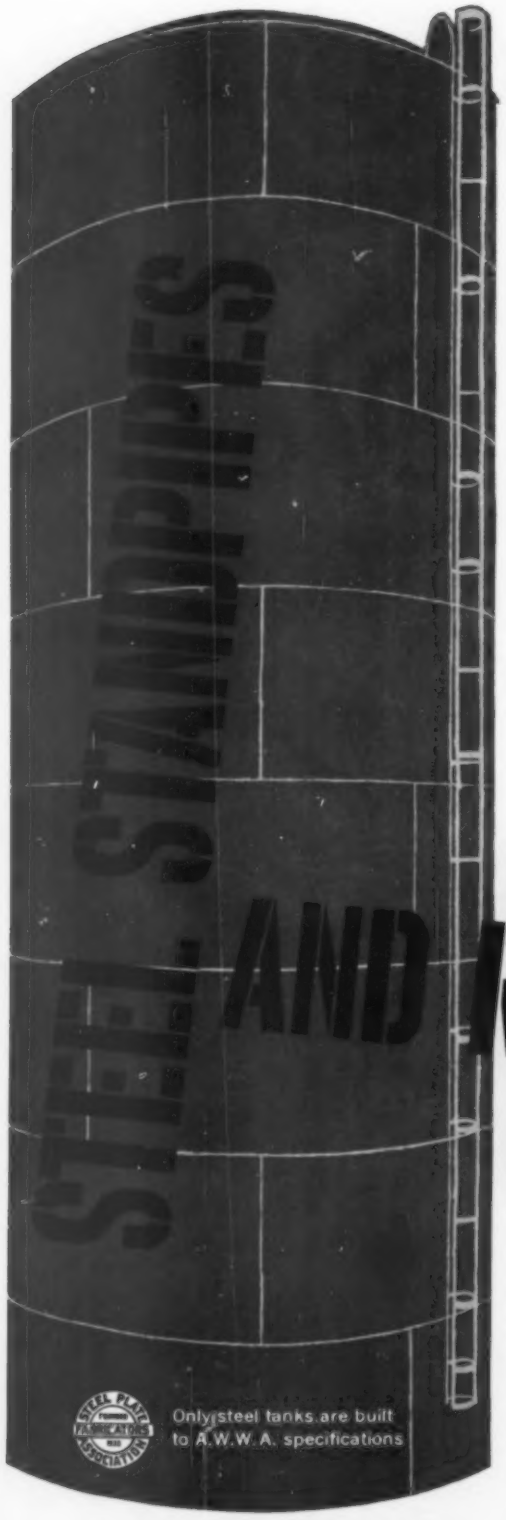

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Erected Anywhere!

From its plants in Pennsylvania, Alabama, Indiana and Utah, General American supplies water storage facilities rapidly, efficiently and inexpensively.

The Field Erection Division maintains experienced crews and modern, efficient erection equipment throughout the country. No matter where you are, you are assured of immediate action and workmanlike construction.

General American steel reservoirs and standpipes are designed for lifetime trouble-free service. Our architects and engineers design exterior treatments to give them a clean modern appearance as well as utility.

Steel storage systems are elastic to protect against cracks when settling occurs, are not damaged by the action of frost, are lightweight, porosity-free, cost less to build and less to maintain than other types.

Your inquiries are invited.

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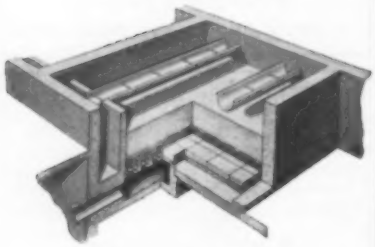

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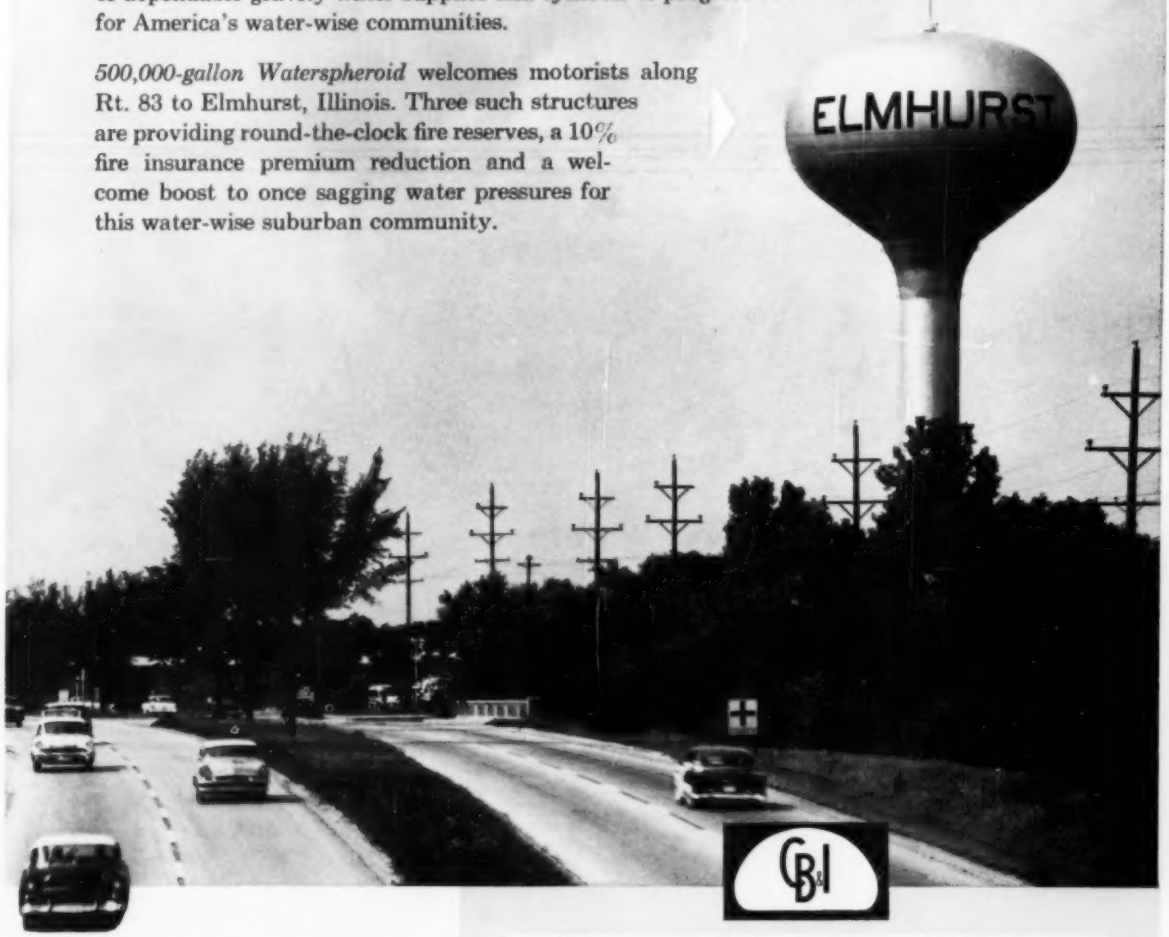

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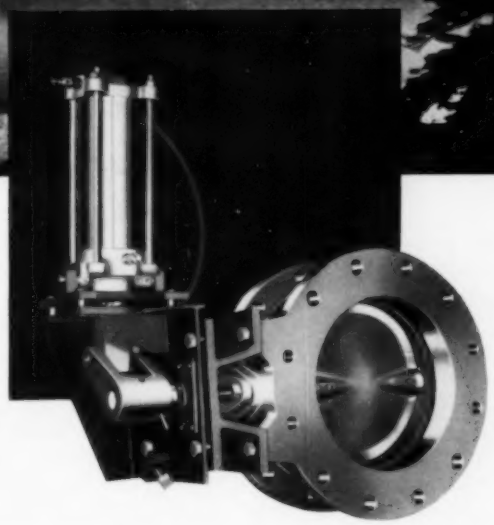

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